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TECHNICAL REPORT 31

EPOXY AND GALVANIZED REINFORCEMENT BARS IN MONOLITHIC CONCRETE BRIDGE DECKS: IN–SERVICE EVALUATION

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Epoxy and Galvanized Reinforcement Bars in Monolithic Concrete Bridge Decks: In-Service Evaluation.

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iii	Line 2 coated galvanized rein-forcement steel.	coated and galvanized reinforcement steel.
30	Paragraph 2, Line 9 The numbers below the horizontal line ---	The numbers below the diagonal line ---
40	Fibure 13B	Figure 13B

EPOXY AND GALVANIZED REINFORCEMENT BARS IN MONOLITHIC CONCRETE BRIDGE DECKS: - IN-SERVICE EVALUATION

Interim Report

Conducted in Conjunction With
The U.S. Department of Transportation
Federal Highway Administration
National Experimental and Evaluation Program (NEEP) No. 16
Coated Reinforcing Steel for Bridge Decks

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(Technical Report 31)

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ABSTRACT

The purpose of this study is to evaluate the in-service performance of epoxy coated galvanized reinforcement steel. These coatings are being investigated as a method of delaying the corrosion of reinforcement bars in concrete bridge decks. To evaluate the performance of coated bars, these materials and uncoated reinforcement have been used in the new construction of monolithic concrete bridge decks at the two test sites.

At the time of construction no problems were encountered with the coating, fabrication or the job site installation of epoxy coated and galvanized reinforcement bars. Epoxy coated bars were not severely damaged in shipment or handling. The only coating defect was an occasional scrape on the deformation of an epoxy bar. These defects were touched-up in the field with liquid repair material. No field repairs were necessary with the galvanized reinforcement bars.

Two performance evaluations have been made at one of the test sites (Arcade, N.Y.). Work on the bridges at the second test site (Interstate Route 88) was not completed until October, 1976. Due to early winter conditions the initial performance survey at this location has been delayed until Spring, 1977. At the Arcade test area the first evaluation was made in 1975, before the bridge was opened to traffic; the second in 1976, after one year of service and one winter season. After one year all bar types are performing satisfactorily. There are no indications of active corrosion and the chloride content at the level of steel reinforcement is not sufficient to promote corrosion ($<$1.3 lbs. Cl^-/c.y.).

The corrosion potential of the galvanized reinforcement has passivated; from 0.3±v. in 1975 to 0.22±v. in 1976. The corrosion potentials of epoxy coated and the uncoated bars have not changed significantly in the first year. The epoxy coated bars show an average corrosion potential of 0.12± and 0.13±v., and the uncoated reinforcement a potential of 0.1±v.

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I. PURPOSE

The purpose of this study is to evaluate the in-service performance of epoxy coated and galvanized reinforcement steel. These coatings are being investigated as a method of delaying the corrosion of reinforcement bars in new monolithic concrete bridge decks.

II. INTRODUCTION

Mechanism of Deterioration

The corrosion of reinforcing steel due to the penetration of de-icing salts has been identified as a major contributing factor in the early deterioration of concrete bridge decks. National concern has arisen over the severity of the problem and the costs of repairing or replacing damaged decks. (Figure 1)

Figure 1 - Deteriorated Bridge Deck (10 yrs. old)

Monolithic concrete bridge decks are permeable. Chloride ions from de-icing salts migrate through the concrete and in their presence the corrosion rate of unprotected steel reinforcement bars is increased.

Normally, steel reinforcement bars react with the atmosphere, or with wet concrete to form a thin, protective oxide film. This film can protect (or delay) the steel from further corrosive attack in certain environments and is said to render the steel "passive." In the absence of de-icing salts, most portland cement concretes offer an environment of high pH (pH about 12-13); an environment that maintains the passivity of the steel reinforcement. When chloride ions penetrate, the protective oxide film is disrupted, the surface of the reinforcement steel becomes depassivated, and the electrolytic conductivity of the concrete deck is increased. In these conditions the

corrosion of the steel reinforcement proceeds at an accelerated rate. The corrosion product (rust) that is formed is 5 to 10 times as voluminous as the original material. This increased volume of the reinforcing bar creates tensile stresses within the concrete which eventually result in cracking, spalling and deterioration of the bridge deck.

Methods of Prevention

Bridge deck deterioration has resulted in extensive research by numerous agencies. As a result of their efforts, several methods have been proposed to prevent corrosion in concrete decks. These include coating reinforcement bars; increasing the thickness of concrete cover; cathodic protection; waterproofing membranes; and less permeable wearing courses (e.g. Dow-SM100, Iowa & Polymer concretes, etc.).

For monolithic bridge deck construction, New York believes that coating reinforcement bars is the most practical method for reducing corrosion, at the present time.

Coated Reinforcement Bars

Research has indicated that several coatings may be suitable for the protection of reinforcement bars, however, only two are commercially available at the present time; these are non-metallic epoxy resins and metallic zinc (galvanized) coatings.

The non-metallic epoxy resins are "barrier" type coatings. They protect the reinforcing bar by forming an impermeable film which prevents the chloride solution from contacting and corroding the surface of the steel bar. Epoxy coatings are inert (non-reactive) in concrete, and salt solutions, and should be capable of providing long-term protection.

Metallic zinc (galvanized) coatings provide both "barrier" and "sacrificial" protection. The continuous layer of zinc coating first serves as a barrier film to protect the steel from corrosion; when the steel surface does become exposed, the zinc protects sacrificially, by corroding itself in preference to the reinforcement bar it is protecting. Research to date is inconclusive in predicting the long term effectiveness of galvanized coatings on reinforcement bars. There is concern that the zinc coating itself will be readily attacked and corrode within the environment of a concrete bridge deck.

Monolithic Bridge Deck Standards in New York

In October, 1976, New York revised its design standards for monolithic concrete bridge decks. The new standards require the use of epoxy coated bars in the top mat of steel reinforcement. This change was made in an effort to control corrosion. The total monolithic concrete deck thickness is specified at 8½ inches. The concrete cover over the epoxy coated top steel is 2½ inches which includes a ½ inch construction tolerance (minimum allowable top cover = 2"). The bottom mat of steel reinforcement contains uncoated bars and the bottom concrete is 1 inch.

III. OBJECTIVES

This study is being conducted in conjunction with National Experimental Evaluation Program (NEEP) No. 16, Coated Reinforcing Steel for Bridge Decks. The primary objective of this program is to evaluate the in-service performance of epoxy coated and zinc coated (galvanized) bars as materials capable of reducing or delaying the corrosion of reinforcing steel. The evaluation will be made by comparison of the coated bars with uncoated reinforcement that has been used in the construction of the same type of monolithic concrete bridge decks.

Secondary objectives will attempt to establish the following:

1. Justification of New York's revised design standard requiring epoxy coated bars in the top mat of steel reinforcement. This change will be justified if the monolithic decks constructed with epoxy coated reinforcement show less deterioration and/or corrosion potential than the decks that are constructed with galvanized and uncoated reinforcing bars.

2. Time-to-Corrosion data for coated and uncoated reinforcement bars that are in-service, and subjected to environmental conditions common to New York State.

3. Cost analysis of coated and uncoated reinforcement as determined by their time-to-corrosion.

IV. TEST SITES

To evaluate epoxy coated and galvanized reinforcement, these materials and uncoated bars have been used in the new construction of 8" thick, monolithic concrete bridge decks. In this design the nominal concrete cover over the top mat of reinforcement is two inches; a 1/4 inch construction tolerance is allowed which provides a minimum concrete cover of 1 3/4 inch. Figure 2 shows a transverse section of the eight-inch monolithic deck. (Note: the eight-inch decks in this study are not the present N.Y.S. design).

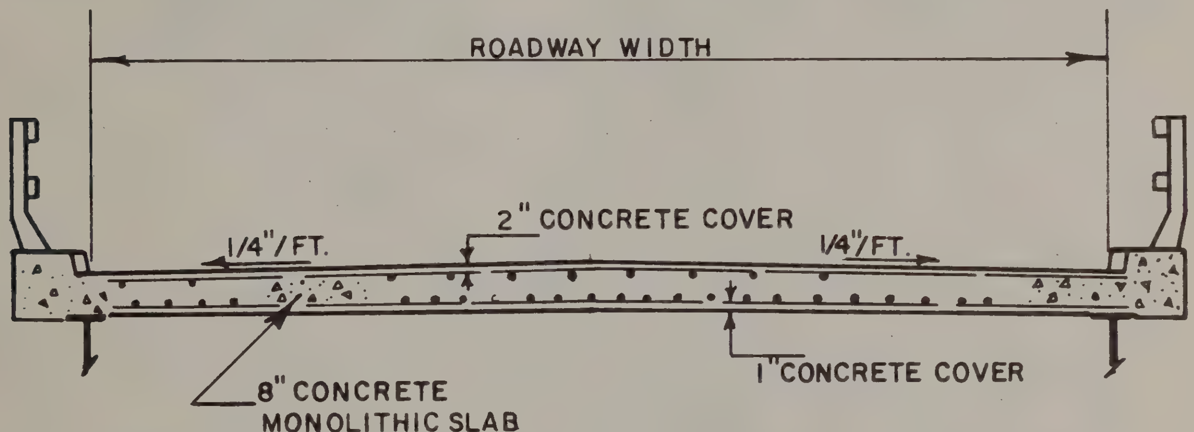

Figure 2 - Typical Transverse Section 8"- Monolithic Bridge Deck

The test structures were built under separate construction contracts and are located on N.Y. Route 39 in Arcade, and on a section of Interstate Route 88, north of Binghamton, N.Y. (Figure 3). For the purpose of recording corrosion potential and A.C. resistance data most of the test structures have been instrumented. The instrumentation consists of a wired "ground" connection to each of 4 longitudinal and 4 transverse reinforcement bars in the top mat; and moisture-temperature sensing devices that are embedded in the concrete at the top level of steel reinforcement (Soiltest MC-363 Moisture-Temperature Cells: Soiltest, Inc., 2205 Lee Street, Evanston, Illinois 60602). The wired connections and sensing devices are terminated in a junction box and are available for use in each evaluation.

Figure 3 - Geographical Location of Test Sites

Arcade Test Site

The bridge in Arcade carries N.Y. Route 39 over the Penn-Central R.R. It was constructed under Contract FARC 74-182; Federal Aid Project No. RF-282 (7). It consists of four simple spans. Two spans are constructed with galvanized reinforcement; one span has epoxy coated reinforcement; and one span contains uncoated reinforcing bars. Individual spans have only one bar type. e.g. epoxy coated bars in the top and bottom mats, and in adjoining sidewalk sections. Figure 4 shows the deck plan at Arcade. The concrete deck for this structure was poured in August, 1975 and the bridge was opened to traffic in September, 1975. A traffic count in August, 1976 showed that the Average Daily Traffic (ADT) was 10,450 vehicles per day (total traffic - four lanes). Each span on this bridge has been instrumented for corrosion measurement.

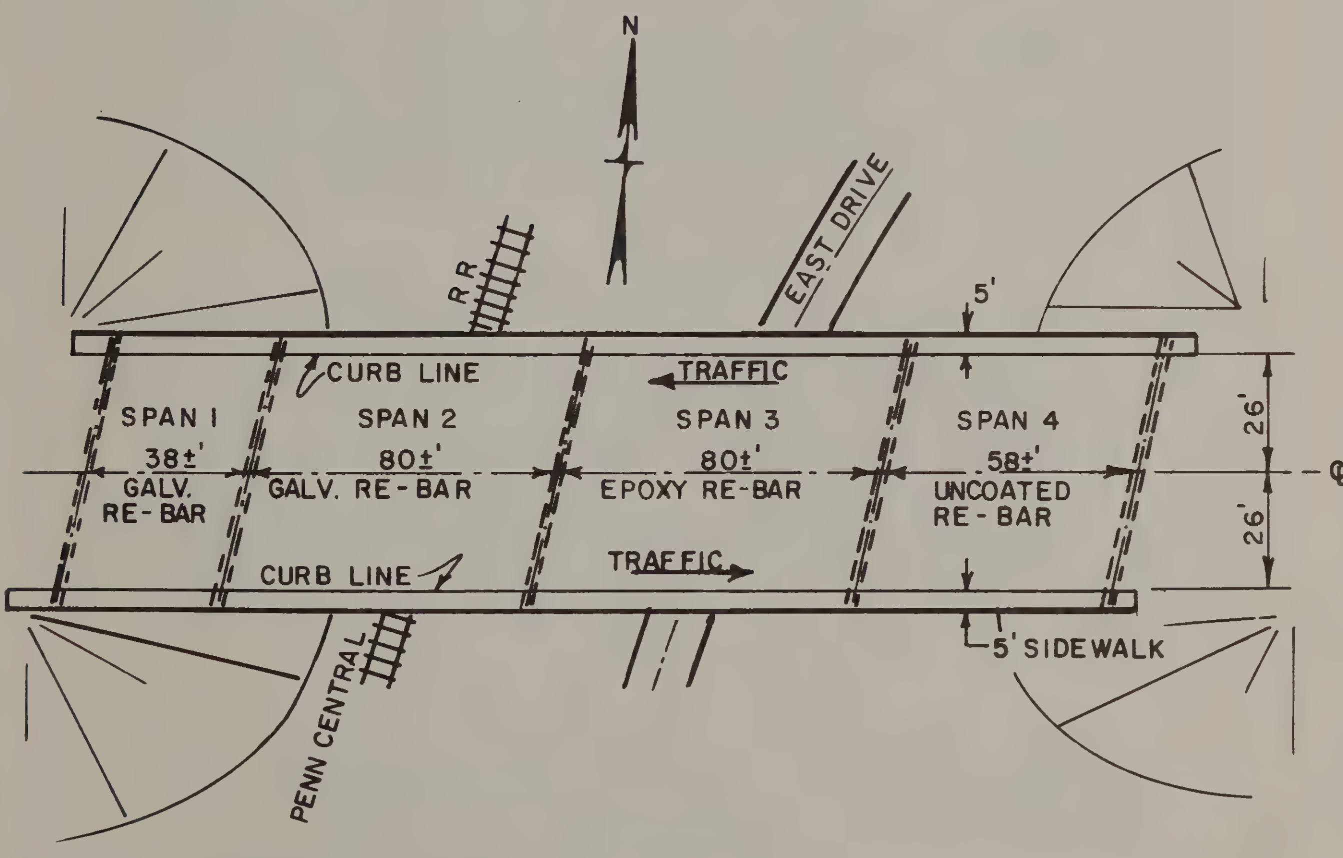

Figure 4 - Arcade Test Site
(Constructea - August, 1975)

Interstate Route 88 Test Site

The test area on Interstate Route 88 includes thirteen separate structures. Six of these are constructed with epoxy coated bars; six with galvanized bars; and one contains uncoated reinforcing steel Each structure has only one type bar reinforcement.

Five of the thirteen bridges will be evaluated in this study. These will include two bridges with epoxy coated reinforcement, two with galvanized bars; and one structure with uncoated reinforcement. The remaining eight bridges will be evaluated visually, but will not receive close attention unless it becomes necessary to verify other data.

The bridges with coated reinforcement steel (epoxy and galvanized) were constructed under Contract D95035; Federal Aid Project No. I-IG-88-I(24): F-496(27): I-88(25). Each bridge consists of one single span. The bridges with epoxy reinforcement are identified as Bridge 1, Eastbound and Westbound, and are located at the Sanitaria Springs exit. The galvanized reinforcement was used on Bridge 9, Eastbound and Westbound structures. Bridge 9 carries I-88 over Route 79 at the Harpursville exit. Figures 5 and 6 show the deck plans for Bridges 1 and 9. The concrete decks for Bridge 1 were poured in August, 1976 and the Bridge 9 decks were cast in October, 1976. None of these bridges will be opened to traffic until the completion of the construction contract in the latter part of 1977. Instrumentation for corrosion measurement is installed on each structure.

The bridge on Interstate 88 with uncoated reinforcement was constructed in conjunction with Contract FARC 72-151; Federal Aid Project No. I-IG-88-1(27): F-360(13). This bridge is identified as Structure No. 11, Westbound and is a 4-span, continuous bridge. It is located approximately 1 mile east of the Harpursville exit; the structure carries I-88 westbound traffic over Schoolhouse Road and the Delaware and Hudson Railroad. Figure 7 shows the deck plan. The concrete deck was poured in June, 1975 and the bridge has been opened to traffic since September, 1975. A traffic count in July, 1976 showed an Average Daily Traffic (ADT) of 3,870 vehicles per day (Total traffic - 2 lanes). This bridge is not instrumented for corrosion measurement at the present time.

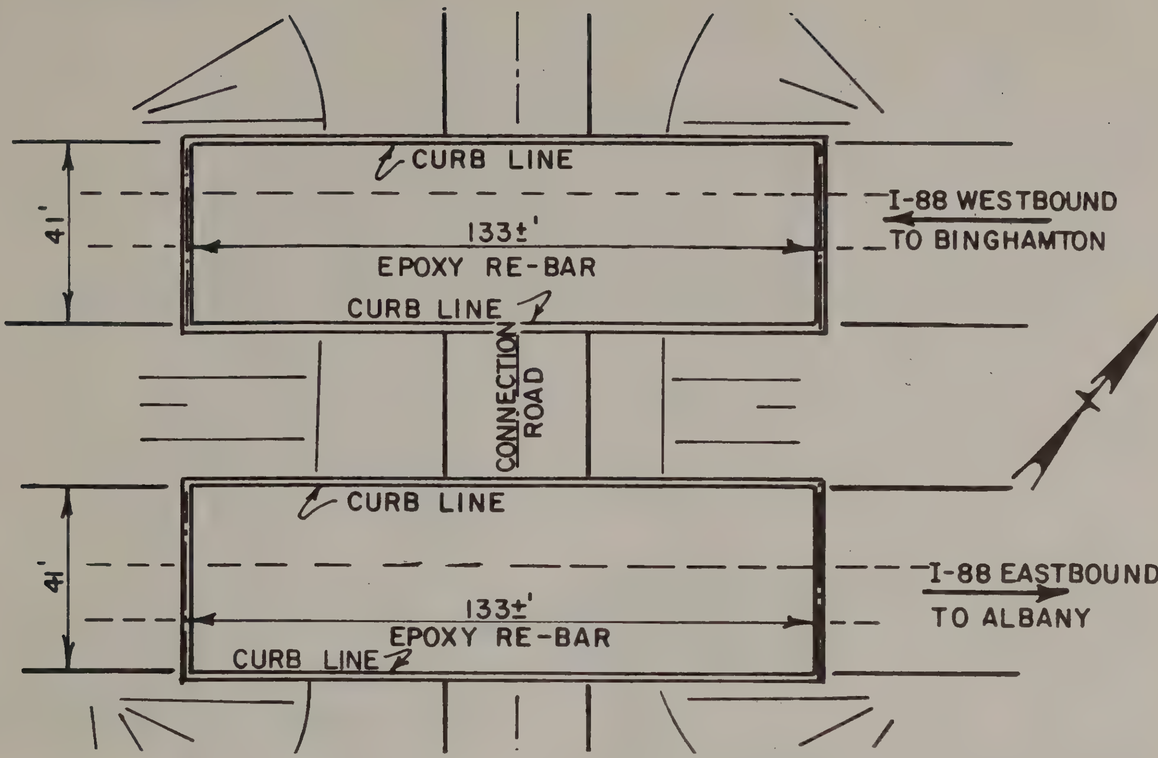

Figure 5-I-88 Test Site
Bridge 1, Eastbound & Westbound (Constructed - August, 1976)

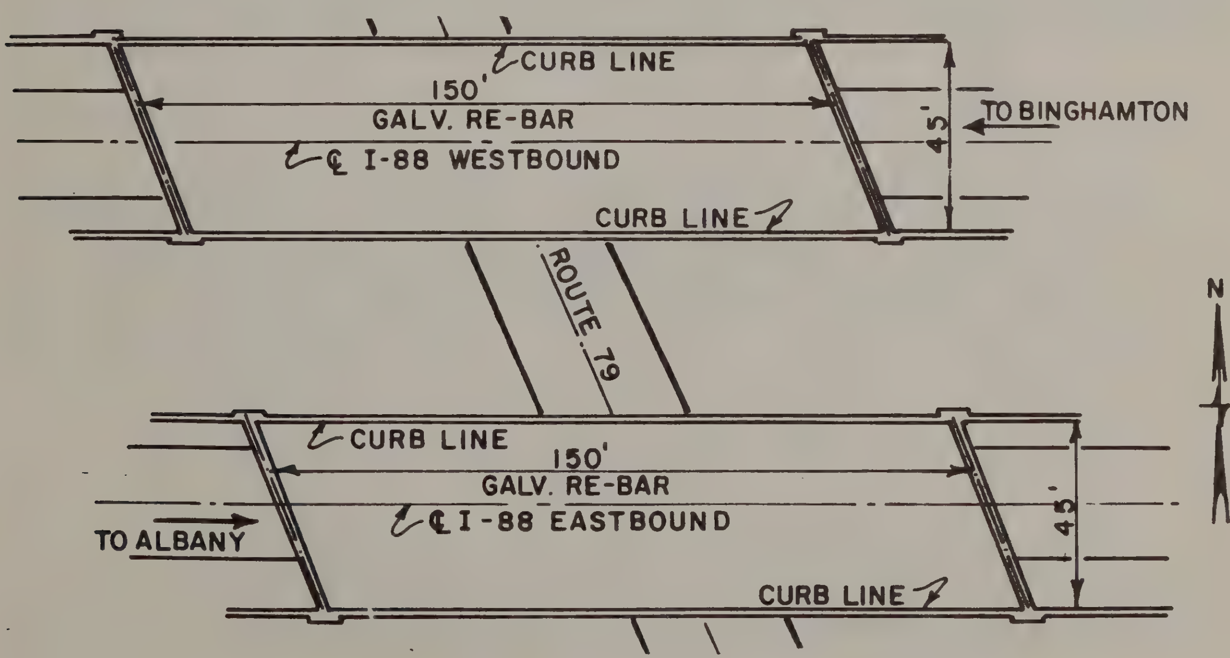

Figure 6-I-88 Test Site
Bridge 9, Eastbound & Westbound (Constructed - October, 1976)

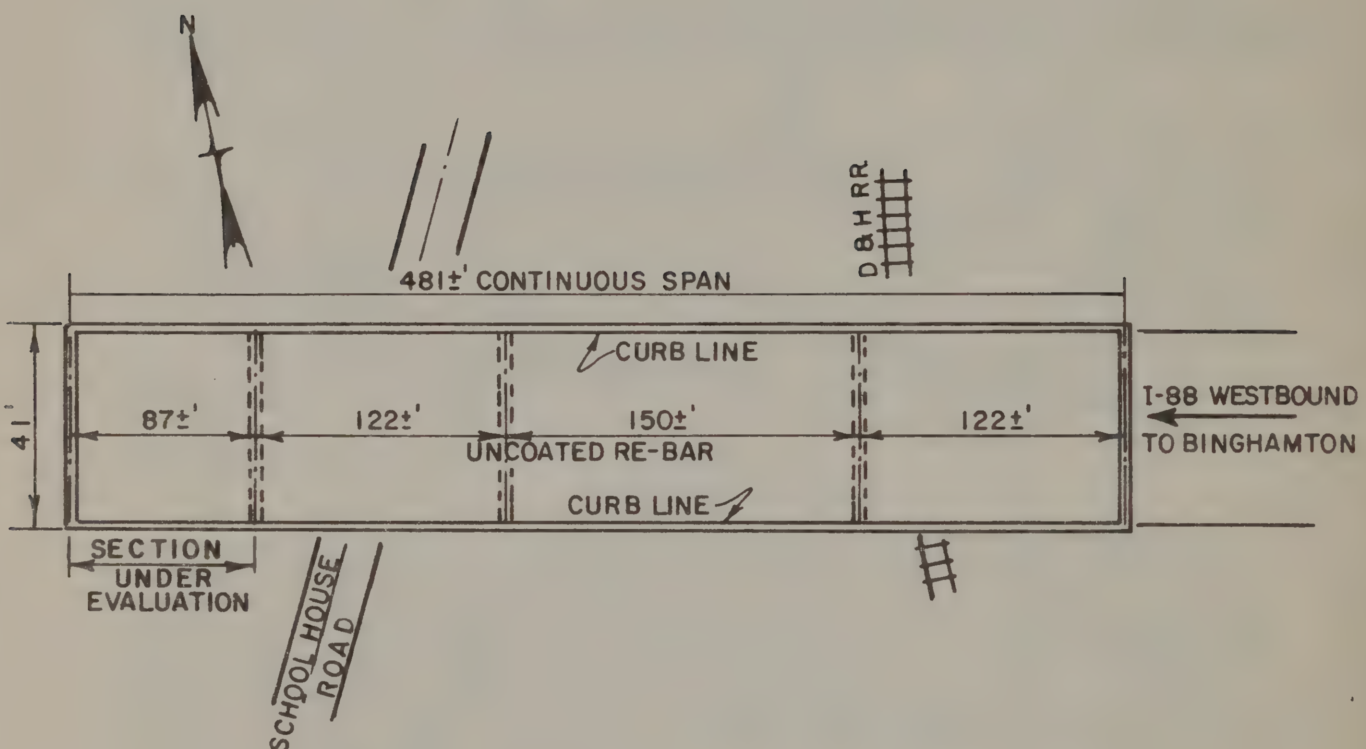

Figure 7—I-88 Test Site
Bridge 11 - Westbound (Constructed - June, 1975)

V. MATERIALS

Concrete for Monolithic Bridge Decks

The bridge decks in this evaluation were constructed using New York's standard Class A concrete mix design for structural slabs. Some general properties of this mix are as follows:

6.3 to 6.4 sacks of cement/cubic yard concrete
Water-Cement Ratio = 0.44
6% Air Entrainment
Maximum Aggregate size = 1 1/2 inch.

Reinforcement Bars

The steel reinforcing bars in this study (uncoated, epoxy coated and galvanized) conform to New York's standard requirements for deformed bars - ASTM A-615, Grade 60.

Galvanized (Zinc) Coating

Galvanized reinforcement bars were hot-dipped galvanized in accordance with ASTM A-123. The average weight of zinc coating was specified at 2.3 oz/s.f. The slab zinc used in the coating process was specified to be equal to "Prime Western" grade (ASTM B-6). After galvanizing the bars were chromate treated. The contract specifications for galvanized reinforcement are given in Appendix A.

Epoxy Coating

The reinforcement bars were coated with an electrostatically applied organic powdered epoxy resin. The applied film thickness was specified at 7 ± 2 mils. In this study the reinforcement bars at both test sites were coated by the same applicator, (M.C.P. Facilities Corp. - Bath, Pa.) and with the same epoxy coating material (DuPont's Flintflex 531-6080). New York's standard specifications and related requirements for epoxy coated reinforcement steel are included in Appendix B.

VI. METHODS OF EVALUATION

To evaluate the in-service performance of epoxy coated and galvanized reinforcement bars, these materials and uncoated bars will be observed during and after construction of the bridges.

Construction Phase

At the time of construction, visual observations of the coating application process will be made at the galvanizer's and epoxy coating applicator's facilities. At the job site a record of construction activities associated with the installation of the reinforcement bars will be kept. Special emphasis will be placed on any problems, unusual features or damage that occurs.

Post Construction Phase

After the concrete deck is placed, and in annual evaluations, the following observations and measurements will be recorded:

1. Visual Observations: - to locate cracks, spalls, areas of scaling and other types of distress.

2. Pachometer Survey: - a "depth of steel" survey will be made with a pachometer to determine the thickness of concrete cover over the top mat of reinforcing steel. This survey will only be done once, after the concrete deck is placed.

3. Delaminations: - a chain drag will be used to detect delaminated areas. Delaminations are usually caused by corrosion of the reinforcement bars. The end result of these defects are spalls.

4. Chloride Content: - chloride samples will be collected from nominal depths of 1", 2" and 3" (samples taken from 3/4 to 1 1/4"; 1 3/4 - 2 1/4" and 2 3/4 - 3 1/4"). Research by others has shown that a chloride content of 1.0 to 1.3 pounds of free chloride per cubic yard of concrete is sufficient to promote active corrosion of uncoated reinforcement bars.

5. Corrosion Potential: - corrosion potential surveys will be made using a copper-copper sulphate half-cell reference electrode. Research with uncoated reinforcement has shown that for half-cell values (CSE) less than 0.20 v., active corrosion is not occurring; and that for values above 0.35 v., active corrosion is occurring. The range of values between 0.2 v. and 0.35 v. represents an area where corrosion activity is undefined.

It should be noted that the values above represent the negative potential of the steel relative to the copper-copper sulphate half cell, e.g. 0.20 v. represents an actual corrosion potential value of -0.20 v. For purposes of this report the negative sign is dropped and a value such as -0.27 v. is recorded as 0.27 v.

The interpretation of corrosion potential values for epoxy coated and galvanized reinforcement has not been defined. Since epoxies are inert and do not react (corrode), the measured half-cell values can be attributed to coating defects and corrosion of the unprotected bar. The values that have been established for uncoated reinforcement should apply to epoxy coated bars; however, in interpreting the data it must be considered that a high corrosion potential value could be due to a localized pinpoint of rust or other factors, and not a general deterioration of the epoxy coating system. Galvanized coatings are sacrificial and corrosion potential measurements for galvanized bars will reflect the corrosion potential of the zinc. The corrosion potential of actively corroding zinc in concrete bridge decks is not known, however, it is expected to be above 0.60 v. (CSE). No interpretation of the corrosion potential measurements on galvanized reinforcement bars will be made at the present time.

6. <u>Resistance Measurements</u>: - A.C. Resistance measurements will be taken with an electrolytic conductivity bridge (Leeds & Northrop, Model 4959 - 1000 cycles/sec). This measurement is intended for epoxy coated reinforcement bars but some random data will be collected on uncoated and galvanized bars. A.C. resistance measurements are intended to evaluate the impermeability (waterproofness) of epoxy coatings, but the usefulness of this measurement technique is questionable. Although a minimum requirement has not been defined, it is believed that an A.C. resistance of 3000 ohms - square foot of reinforcement bar surface area represents a satisfactory epoxy coating. By comparison, uncoated reinforcement bars are reported to have an A.C. resistance of 300 ohms - square foot.

   A.C. resistance measurements will be tabulated in Appendix D. This information will not be used to evaluate the performance of reinforcement bars at the present time. It may be used for this purpose in the future and for the purpose of determining the usefulness of the A.C. Resistance test.

VII. OBSERVATIONS AND MEASUREMENTS

Construction Phase

1. Application of Epoxy and Galvanized Coatings

There were no problems with the shop manufacture of either the epoxy coated or galvanized reinforcement bars. All specification requirements for these materials were met. The epoxy coated bars were not damaged in handling or fabrication and "touch-up" work in the shop was minimal. The average measured coating thickness on epoxy bars was 8 mils (spec. = 7 ± 2 mils); the galvanized coating was measured at 6 mils, average (spec. = $\overline{2}.3$ oz/s.f. avg., = 4 mils).

2. Installation of Coated Reinforcement Bars

No difficulties were encountered with the installation of the coated bars. It had been thought that the epoxy bars might be damaged in shipment and handling at the job site. This was not the case. The only coating defect was an occasional scrape on the deformation of an epoxy coated bar. These defects were touched-up using a brush and liquid repair material, after the reinforcing mat was installed. No field repairs were necessary with the galvanized reinforcement bars.

The coated bars were installed by conventional methods. The work time required to place them was comparable to that for the installation of uncoated reinforcement. Epoxy coated reinforcing mats were placed using epoxy coated chairs and plastic coated tie wires; the galvanized reinforcement was installed with galvanized supports and galvanized ties.

Post Conctruction Phase

Interstate Route 88 Test Site

No performance evaluations have been made at this test site. The concrete deck work on the structures with epoxy coated and galvanized bars (Bridges 1 and 9) was not completed until October, 1976. Due to early winter weather, the initial evaluation and data collection on these structures and on the control section (Bridge 11) with uncoated bars has been postponed until Spring, 1977.

Arcade Test Site

The test site at Arcade has been evaluated twice. Once in October, 1975, immediately after construction and before the bridge was opened to traffic; and again after one year of service in October, 1976. The following are the results of these evaluations:

1. Visual Observations

   After the deck was poured (1975) no visual defects were noted. After one year of service (1976) eight to ten random transverse cracks (4-6' long) are visible on the underside of both Span 1 (galvanized bars) and Span 4 (uncoated bars). Some form of efflorescence (white deposit) accompanies the cracks. These cracks are not visible on the deck surface so it is believed that they are shrinkage cracks, and not due to corrosion of the reinforcement steel. No other defects are visible on Spans 1 and 4. Span 2 (galvanized bars) and Span 3 (epoxy coated bars) show no visual deterioration.

2. Pachometer Survey

   The depth of steel survey was taken in 1975. This measurement was recorded on a five foot coordinate grid. The results of the pachometer survey are shown in the computer contour mapping (SYMAP) of Figures 8-11. Individual data measurements are included in Appendix C.

   The average depth of concrete cover for each span and its standard deviation are summarized below.

Span No./Reinforcement	Mean Depth Conc. Cover (inch)	Stand. Dev.	Min. Conc. Cover (")	Max. Conc. Cover (")	Number of Measure-ments
Span 1 - Galvanized	2.6296	0.2684	2.25	3.00	81
Span 2 - Galvanized	2.2238	0.3815	1.50	3.00	172
Span 3 - Epoxy Coated	2.1568	0.3522	1.25	3.00	169
Span 4 - Uncoated	2.300	0.2560	1.75	3.00	125

To determine if there is a significant difference between the average depth of concrete covers, a one-way analysis of variance was computed. Using each span as a treatment variable, it can be concluded from the following analysis that there is a significant difference between the mean pachometer values when tested at the 0.95 level. This information may be useful in the future to account for corrosion potential activity.

ANALYSIS OF VARIANCE TABLE

(Pachometer Data: Each Span = Treatment Variable)

	Sum of Squares	Degrees of Freedom	Mean Square	F
Between Groups	13.06	3.00	4.35	39.65
Within Groups	59.62	543.00	0.11	
Totals	72.67	546.00		

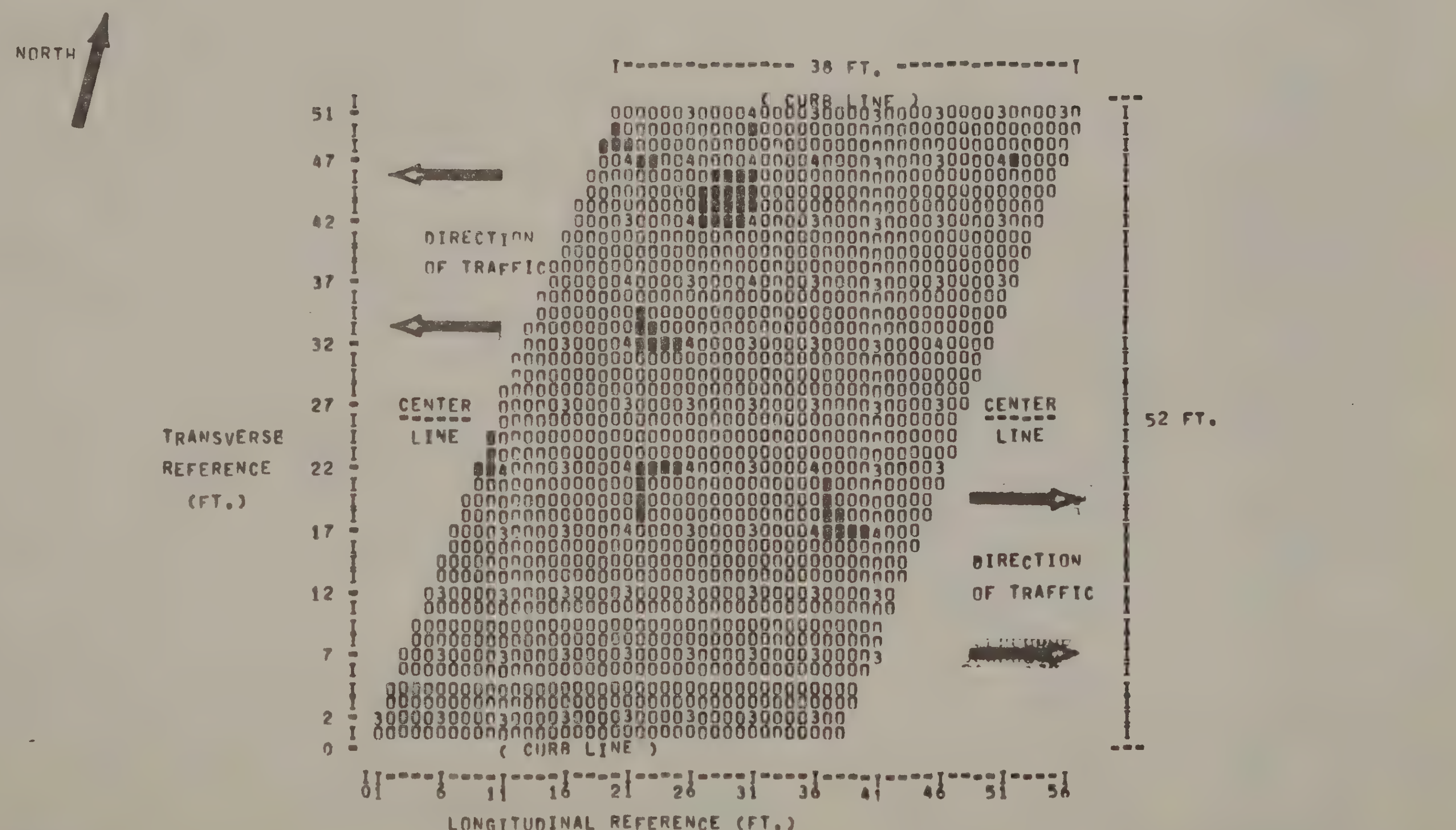

Figure 8
Pachometer Readings

ARCADE TEST SITE
SPAN 1 - GALVANIZED REINFORCEMENT
SCALE 1 IN. = 10 FT.

SYMAP

COUNTY LINE-ARCADE FARC 74-182 PIN 4008.00.321

SPAN NO. 1 PACHOMETER READINGS 9/30/75

DATA VALUE EXTREMES ARE 2.25 3.00

ABSOLUTE VALUE RANGE APPLYING TO EACH LEVEL
("MAXIMUM" INCLUDED IN HIGHEST LEVEL ONLY)

MINIMUM	0.00	1.00	2.00	3.00
MAXIMUM	1.00	2.00	3.00	4.00

PERCENTAGE OF TOTAL ABSOLUTE VALUE RANGE APPLYING TO EACH LEVEL

25.00	25.00	25.00	25.00

FREQUENCY DISTRIBUTION OF DATA POINT VALUES IN EACH LEVEL

```
 LEVEL          1          2          3          4
          ==========================================
          .........  +++++++++  000000000  █████████
          .........  +++++++++  000000000  █████████
 SYMBOLS  ....1....  ++++2++++  000030000  ████4████
          .........  +++++++++  000000000  █████████
          .........  +++++++++  000000000  █████████
          ==========================================
 FREQ.          0          0         61         20
```

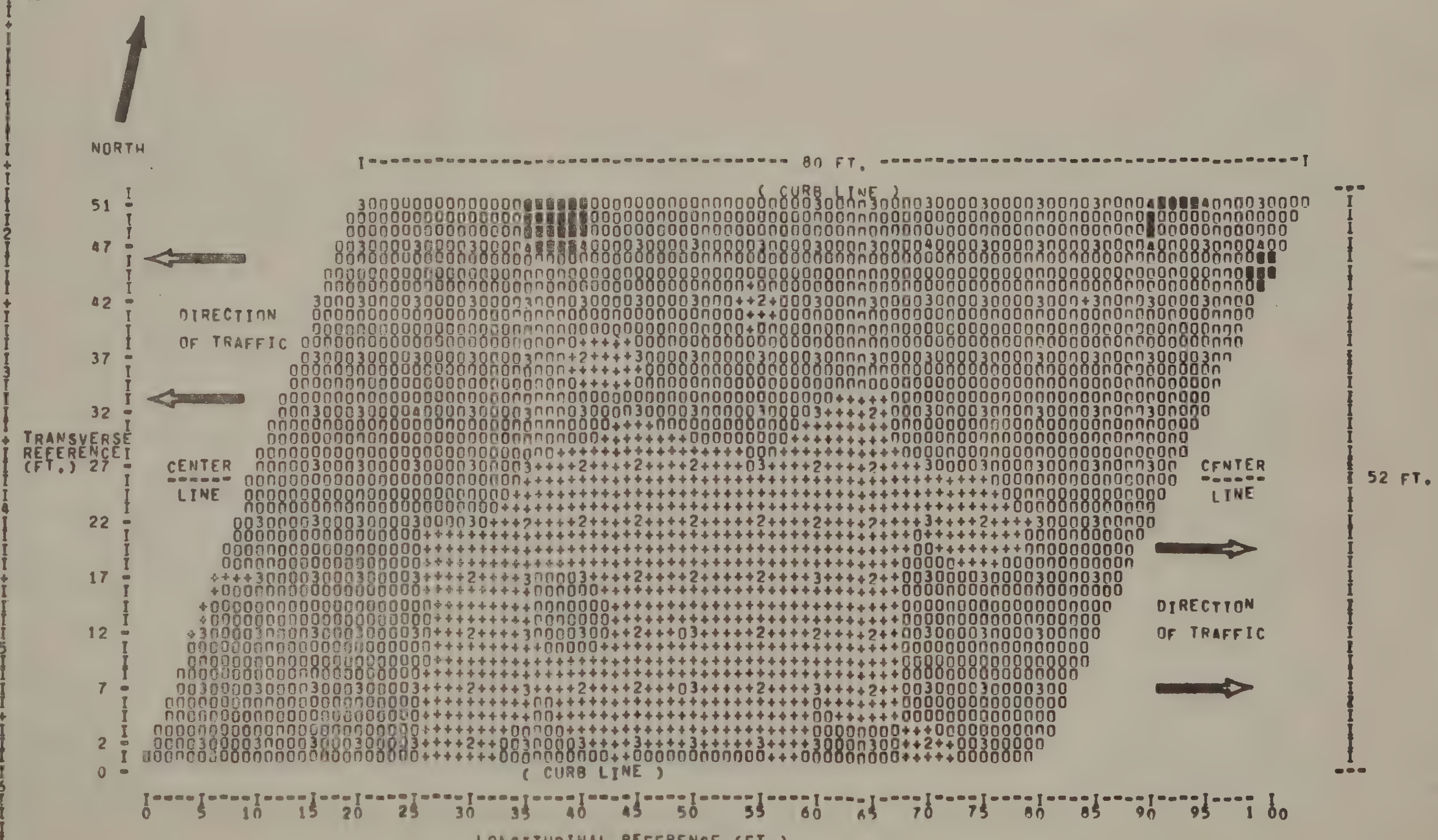

Figure 9
Pachometer Readings

ARCADE TEST SITE
SPAN 2 - GALVANIZED REINFORCEMENT
SCALE 1 IN. = 10 FT.

SYMAP

```
COUNTY LINE-ARCADE   FARC 74-182   PIN 4008.00.321
SPAN NO. 2- PACHOMETER READINGS  9/30/75



DATA VALUE EXTREMES ARE          1.50         3.00


ABSOLUTE VALUE RANGE APPLYING TO EACH LEVEL
       ("MAXIMUM" INCLUDED IN HIGHEST LEVEL ONLY)

  MINIMUM       0.00       1.00       2.00       3.00
  MAXIMUM       1.00       2.00       3.00       4.00

PERCENTAGE OF TOTAL ABSOLUTE VALUE RANGE APPLYING TO EACH LEVEL

               25.00      25.00      25.00      25.00

FREQUENCY DISTRIBUTION OF DATA POINT VALUES IN EACH LEVEL
  LEVEL           1          2          3          4
          ===========================================
           .........  +++++++++  000000000  █████████
           .........  +++++++++  000000000  █████████
  SYMBOLS  ....1....  ++++2++++  000030000  ████4████
           .........  +++++++++  000000000  █████████
           .........  +++++++++  000000000  █████████
          ===========================================
  FREQ.           0         33        131          8
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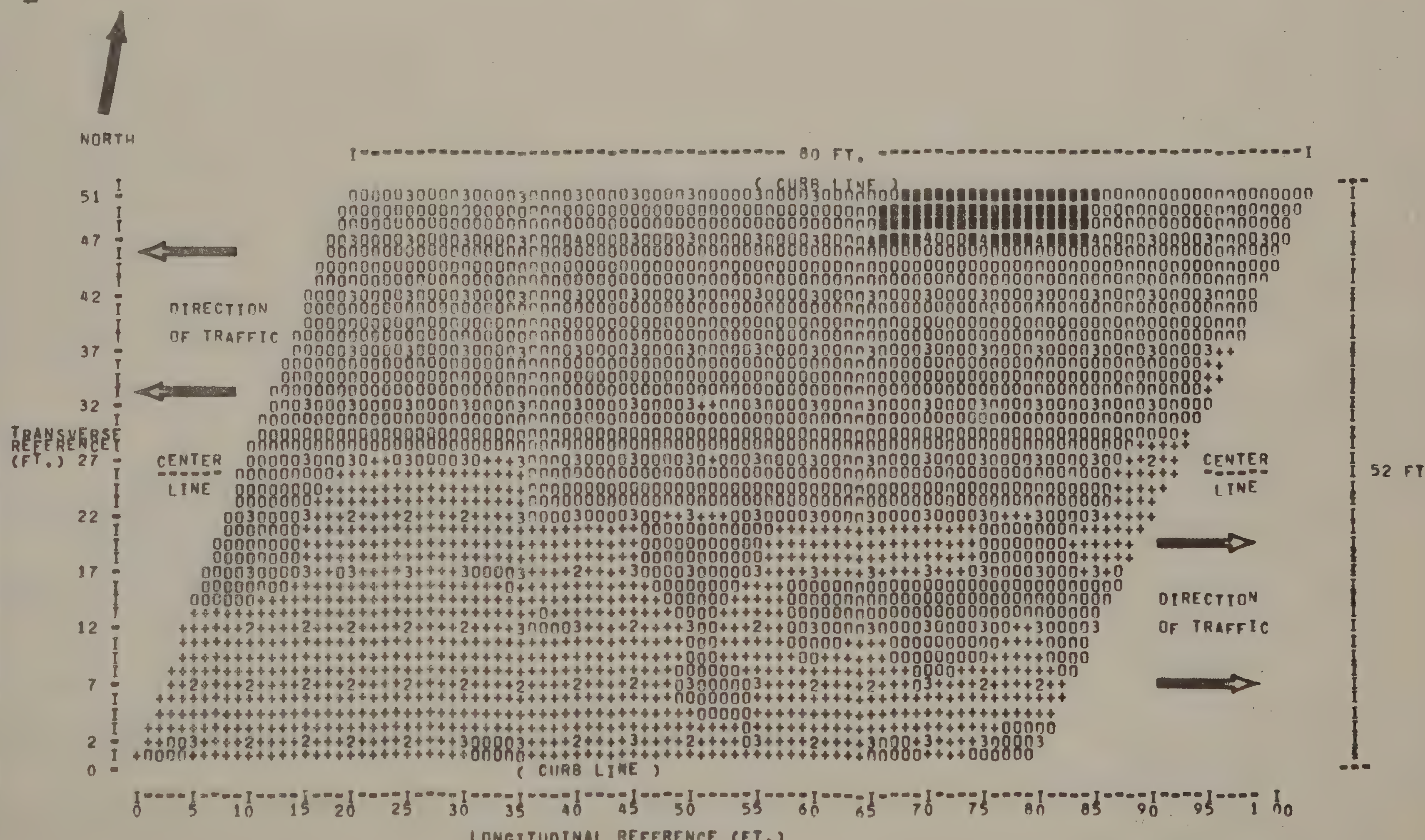

Figure 10
Pachometer Readings

ARCADE TEST SITE
SPAN 3 - EPOXY COATED REINFORCEMENT
SCALE 1 IN. = 10 FT.

SYMAP

```
COUNTY LINE-ARCADE   FARC 74-182   PIN 4008.00.321
SPAN NO. 3- PACHOMETER READINGS  10/1/75


DATA VALUE EXTREMES ARE          1.25        3.00


ABSOLUTE VALUE RANGE APPLYING TO EACH LEVEL
       ("MAXIMUM" INCLUDED IN HIGHEST LEVEL ONLY)

  MINIMUM      0.00       1.00       2.00       3.00
  MAXIMUM      1.00       2.00       3.00       4.00

PERCENTAGE OF TOTAL ABSOLUTE VALUE RANGE APPLYING TO EACH LEVEL

              25.00      25.00      25.00      25.00

FREQUENCY DISTRIBUTION OF DATA POINT VALUES IN EACH LEVEL
  LEVEL          1          2          3          4
            ========================================
            .........  +++++++++  000000000  █████████
            .........  +++++++++  000000000  █████████
  SYMBOLS   ....1....  ++++2++++  000030000  ████4████
            .........  +++++++++  000000000  █████████
            .........  +++++++++  000000000  █████████
            ========================================
  FREQ.          0         32        131          6
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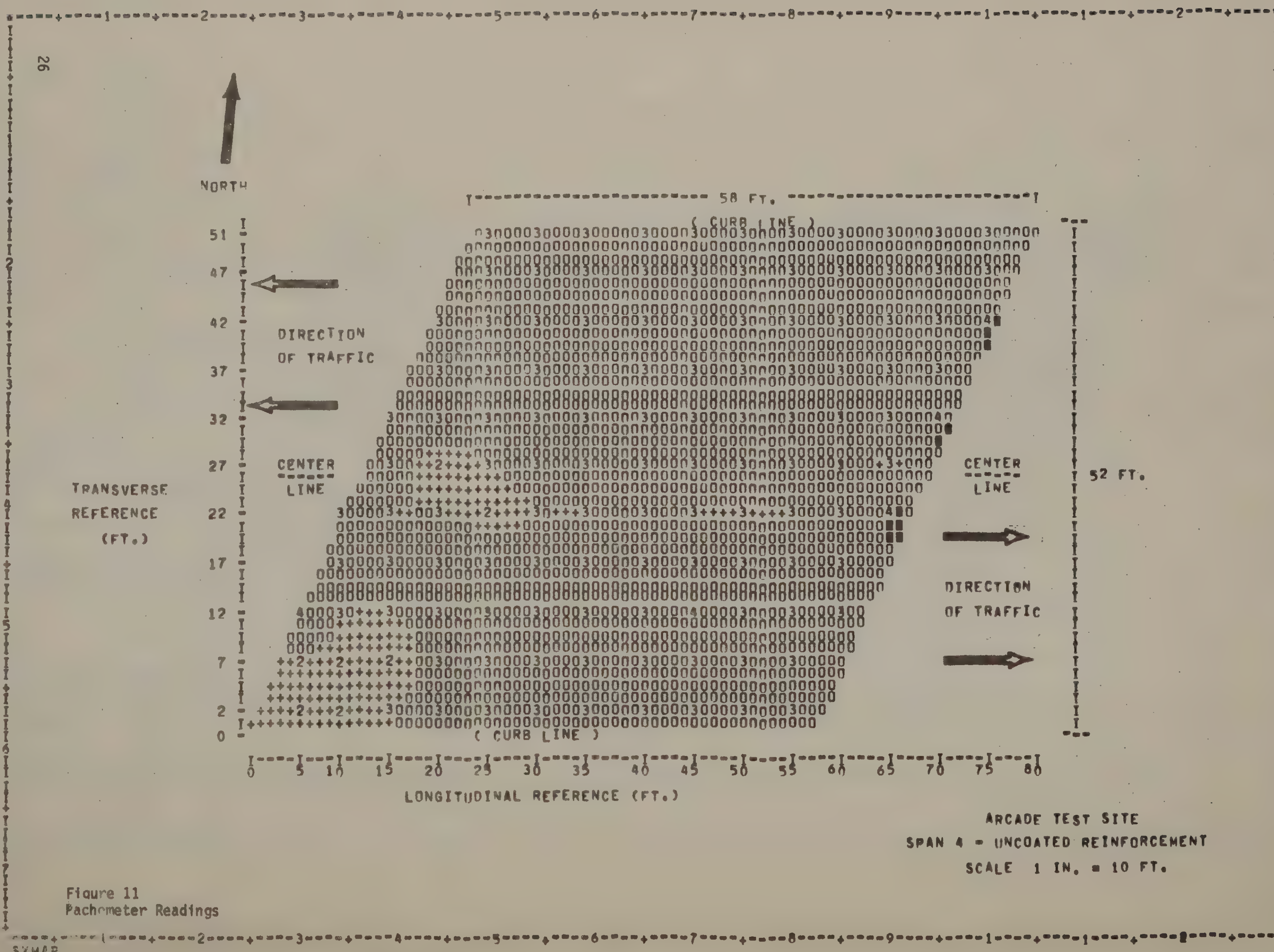


Figure 11
Pachometer Readings

```
COUNTY LINE-ARCADE   FARC 74-182   PIN 4008.00.321
SPAN NO. 4- PACHOMETER READINGS  10/2/75


DATA VALUE EXTREMES ARE          1.75          3.00


ABSOLUTE VALUE RANGE APPLYING TO EACH LEVEL
       ("MAXIMUM" INCLUDED IN HIGHEST LEVEL ONLY)

  MINIMUM       0.00       1.00       2.00       3.00
  MAXIMUM       1.00       2.00       3.00       4.00

PERCENTAGE OF TOTAL ABSOLUTE VALUE RANGE APPLYING TO EACH LEVEL

               25.00      25.00      25.00      25.00

FREQUENCY DISTRIBUTION OF DATA POINT VALUES IN EACH LEVEL
  LEVEL           1          2          3          4
          ==========================================
           .........  +++++++++  000000000  █████████
           .........  +++++++++  000000000  █████████
  SYMBOLS  ....1....  ++++2++++  000030000  ████4████
           .........  +++++++++  000000000  █████████
           .........  +++++++++  000000000  █████████
          ==========================================
  FREQ.           0          7        113          5
```

3. Delaminations

This evaluation has not been performed. The next survey at Arcade will include a chain drag to detect delaminated areas.

4. Chloride Content

In both the 1975 and 1976 evaluations, chloride samples were taken from four random locations on each span. At each of the four locations, concrete powder was collected for analysis at nominal depths of one, two, and three inches. Table 1 gives the average chloride content of the four locations, at each depth, for each of the spans.

The samples taken in 1975, reflect the chloride content of a new, un-salted bridge deck. The samples in 1976 show the chlorides after one year of service and one winter de-icing season. The zero chloride contents in Table 1 are probably due to collection of the chloride sample from stone aggregate, rather than from concrete mortar; or from dissipation of initial chloride values due to rain and wet weather. Despite the zero samples the data is sufficient to indicate that the chloride content at the level of reinforcement is below the threshold of 1.3 lbs. Cl^-/cy.; and that the chloride content of the deck after one year of service, is not high enough to provide a corrosive environment for the reinforcement.

TABLE 1 - SUMMARY OF CHLORIDE ANALYSIS

Span No.	Sample Depth	Chloride Content Avg. 4 Locations (lbs. Cl^-/c.y.) 1975	1976
1	1"	0.6	2.0
	2"	0.7	0.5
	3"	0.7	0.3
2	1"	0.6	1.5
	2"	0.7	0
	3"	0.7	0
3	1"	0.7	1.4
	2"	0.5	0.3
	3"	0.6	0
4	1"	0.5	0.7
	2"	0.1	0
	3"	0.3	0

5. Corrosion Potential

The corrosion potential data will be interpreted as previously described in the section titled, Methods of Evaluation. Briefly, for uncoated reinforcing bars, corrosion potentials of less than 0.20 v. indicate that active corrosion is not occurring; values greater than 0.35 v. indicate that active corrosion is occurring. Epoxy coated reinforcing bars will be evaluated against the same criteria, taking into consideration that high corrosion potential values may be due to localized coating breaks. The corrosion potential of actively corroding galvanized reinforcing bars has not been defined; - however it is believed that this value is greater than 0.60 v.

To provide a basis of data interpretation, three methods of computer analysis will be used. Before discussing the results of the corrosion potential surveys, an explanation of the methods of analysis are given first:

A. Methods of Analysis

1. Contour Mapping

Contour maps will be plotted to visually display areas of corrosion activity. These maps are prepared by plotting the corrosion potential values in the intervals of 0-0.19 v.; 0.20-0.35 v.; and >0.35 v.

2. Measurement Frequency

This analysis in intended to explain the changes in contour maps. It shows the frequency of occurrence of the number of measurements in a corrosion interval, and explains how the change (increased or decreased corrosion potential) occurred between two consecutive surveys. The analysis is presented in table form. The table gives the total number of individual data measurement points in the corrosion potential intervals of 0-0.19 v.; 0.20-0.35 v. and >0.35 v; and it shows how this total number of measurements has changed, in comparison to the previous year's survey. To illustrate, the following is a comparison of the corrosion potential data measurements for the galvanized reinforcement in Span 2.

1975 Corrosion Potentials (No. of Measured Values in Interval)	1976 Corrosion Potentials (No. of Measured Values in Interval) 0-0.19 v.	0.20-0.35 v.	>0.35 v.	1975 Total Meas.
0-0.19 v.	2	7	0	9
0.20-0.35 v.	34	79	0	113
>0.35 v.	26	22	1	49
1976-Total Meas.	62	108	1	

The corrosion potential intervals for the 1976 survey are at the top of the table; the corrosion intervals for 1975 are at the left side of the table. The total number of measurements within an interval for 1976 is shown at the bottom of the table. This total is obtained by adding the vertical column of measurements down the table. (e.g. Total 1976 measurements in the 0-0.19 v. interval = 62 = 2+34+26). The number of 1975 survey measurements are added across the table and the totals are shown at the right side. (e.g. Total 1975 survey measurements in the >0.35 v. interval = 49 = 26+22+1).

The values between the diagonal lines are the number of measured values in each of the two survey years that have not changed and are in the same corrosion potential interval (e.g. 79 measurements that were in the 0.20-0.35v. interval in 1975, are in the same interval in 1976). The numbers above the diagonal line are the number of measurements that increased to a higher potential interval in 1976 (e.g. 7 measurements that were in the 0-0.19v. interval in 1975, increased to the 0.20-0.35v. interval in 1976). The numbers below the horizontal line represent the number of measurements that decreased to a lower level in 1976 (e.g. 22 measurements that were in the >0.35v. interval in 1975 decreased to the 0.2-0.35v. interval in 1976).

3. Corrosion Potential Difference

This method shows the direction of change in corrosion potentials between consecutive surveys. The analysis consists of the preparation of contour maps to show the areas of changing corrosion potential. Good areas are shown in white (+) and are defined as areas where there is no difference in corrosion potential (zero change), or where the corrosion potential value in 1976 was less than the 1975 measurement (1976 − 1975 $\leq$ 0). Bad areas are plotted in black (■) and represent areas where higher corrosion potentials were measured in 1976 than 1975 (1976 − 1975 >0).

B. Results of Corrosion Potential Surveys (1975-1976)

Corrosion potential surveys were taken on a 5' coordinate grid. The corrosion potential data from each of the 1975 and 1976 evaluations is tabulated in Appendix C.

Table 2 summarizes the mean of the corrosion potential values, and the mean of the difference in potentials for each span. The mean difference in potential is obtained by subtracting the individual 1975 measurement from the 1976 measurement and then averaging the values for each span. A negative 76-75 Difference indicates a lower corrosion potential in the latter survey.

Examination of Table 2 shows that the galvanized reinforcement bars have passivated; the 76-75 difference shows that the average corrosion potential on Span 1 is lower by 0.07 ± v. and on Span 2 by 0.10 ± v. The average corrosion potential of the epoxy coated bars has stayed about the same in each survey (0.12-0.13 v.), and is less than 0.20 v. which indicates that active corrosion is not occurring. The 76-75 Difference of 0.0047 v. shows a slight increase in corrosion potential for the epoxy coated bars, but the increase is insignificant.

The uncoated reinforcement in Span 4, has an average corrosion potential of about 0.10 v. in each evaluation. Active corrosion is not occurring. The 76-75 Difference shows a decrease in corrosion potential but again, this value (-0.0077 v.) is not significant.

TABLE 2 SUMMARY OF CORROSION POTENTIALS

Span N^o/Reinforcement	Mean Corr. Pote. (volts)	Std. Dev.	Min. Corr. Pote. (volts)	Max. Corr. Pote. (Volts)	No. of Meas.
Span 1 - Galvanized					
1975 Survey	0.2969	0.0458	0.17	0.39	
1976 "	0.2287	0.0425	0.11	0.31	
76-75 Difference	-0.0681	0.0690	-0.21	0.14	80
Span 2 - Galvanized					
1975 Survey	0.3135	0.0714	0.14	0.50	
1976 "	0.2119	0.0581	0.01	0.36	
76-75 Difference	-0.1015	0.0932	-0.36	0.09	171
Span 3 - Epoxy Coated					
1975 Survey	0.1226	0.0308	0.02	0.20	
1976 "	0.1273	0.0474	0.02	0.29	
76-75 Difference	0.0047	0.0575	-0.15	0.15	173
Span 4 - Uncoated					
1975 Survey	0.0979	0.0202	0.06	0.20	
1976 "	0.0965	0.0378	0.01	0.24	
76-75 Difference	-0.0077	0.0510	-0.19	0.11	123

Note: A paired "t" test on the epoxy coated and uncoated reinforcement steel corrosion potentials cannot reject the hypothesis that no difference exists between 1975 and 1976, at the 95% level. The same hypothesis is rejected for the galvanized reinforcement steel.

It should be noted that eight of the data points on Span 3 (epoxy coated bars) are located over a wired ground connection. These measurements are designated in Appendix C. The average corrosion potential of these eight points was 0.21 v. in 1976; the 76-75 Difference is 0.07 v. These values are higher than the span average, but it is believed that the span average is a better indicator of corrosion potential activity. The eight wired connections are located at the ends of the span; the bridge joints on this structure are steel faced, and it is probable that they have an influence on the "end of span" measurements. For information, the span measurements (five foot grid) are recorded using a common connection of the eight wired grounds; a circuitry check indicates that there is a common ground (continuity) in the coated reinforcing mat. The total measured resistance through the reinforcing mat is less than three ohms.

The following are the results of the computer analysis of corrosion potentials for each type of reinforcement bar:

1. Galvanized Reinforcement Bars

   A. Contour Maps

      Figure 12 (a & b) and 13 (a & b) are corrosion potential contour maps for the galvanized reinforcement in Spans 1 and 2. A visual examination of these shows that the corrosion potentials in 1976 are lower than in 1975. A general passivation of the galvanized reinforcing steel has occurred. The contour map data for 1976 shows that all the corrosion potential values, except for one measurement on each span are less than 0.36 v.; and the majority of measurements are in the 0.20-0.35 v. corrosion potential interval. The one maximum value on each span was recorded as 0.36 v. All corrosion potential measurements are below the 0.60 v. threshold, which is believed to be near the potential of corroding zinc.

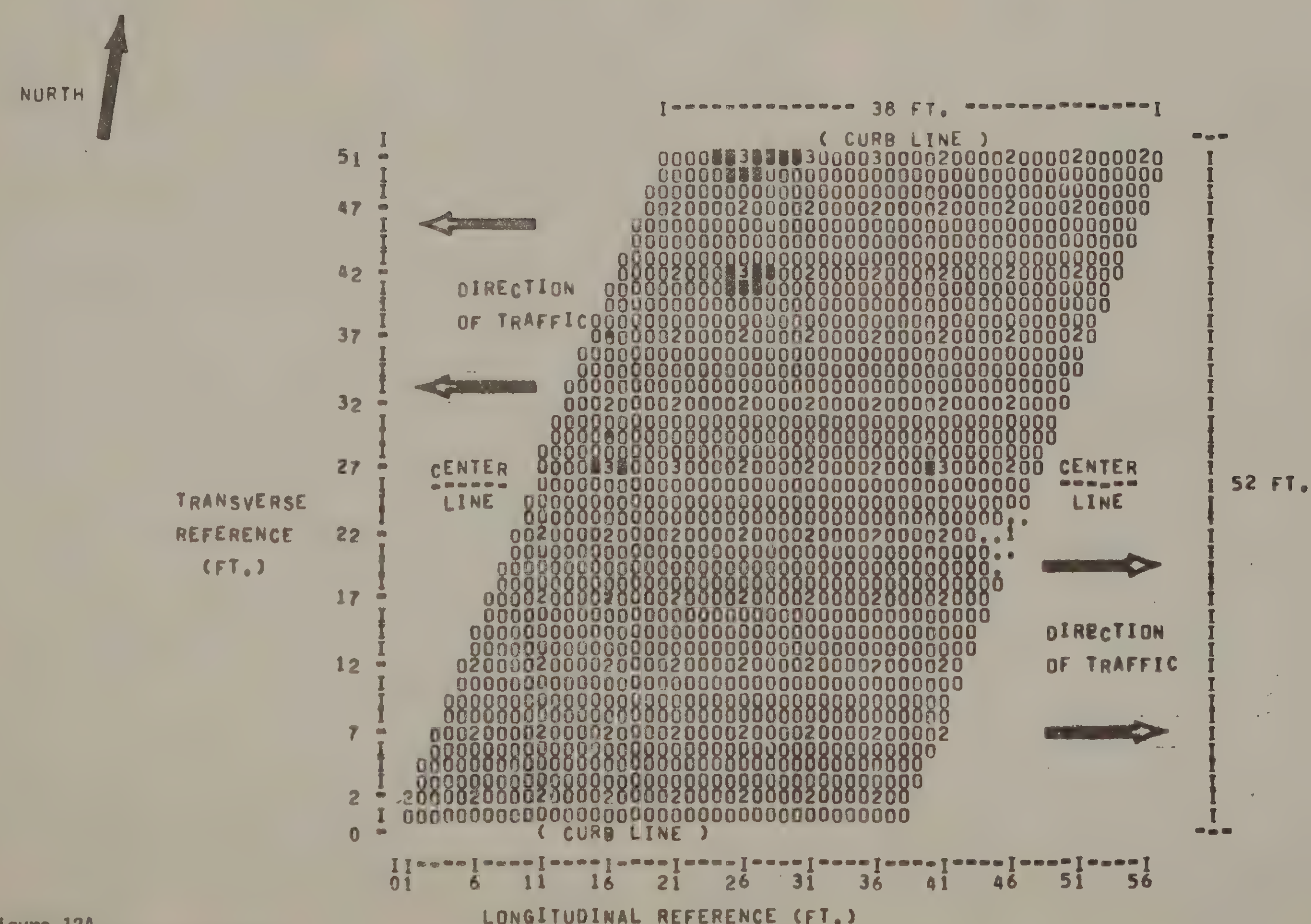


Figure 12A
Corrosion Potential Readings
1975 Survey

ARCADE TEST SITE
SPAN 1 - GALVANIZED REINFORCEMENT
SCALE 1 IN. = 10 FT.

COUNTY LINE-ARCADE   FARC 74-182   PIN 4008.00.321
SPAN NO. 1 - CORROSION POTENTIAL READINGS   9/30/75

DATA VALUE EXTREMES ARE   0.17   0.39

ABSOLUTE VALUE RANGE APPLYING TO EACH LEVEL
("MAXIMUM" INCLUDED IN HIGHEST LEVEL ONLY)

MINIMUM	0.00	0.20	0.36
MAXIMUM	0.20	0.36	0.60

PERCENTAGE OF TOTAL ABSOLUTE VALUE RANGE APPLYING TO EACH LEVEL

33.33	26.67	40.00

FREQUENCY DISTRIBUTION OF DATA POINT VALUES IN EACH LEVEL

```
  LEVEL         1         2         3
          ==============================
          ......... 000000000 █████████
          ......... 000000000 █████████
  SYMBOLS ....1.... 000020000 ████3████
          ......... 000000000 █████████
          ......... 000000000 █████████
          ==============================
  FREQ.         1        73         7
```

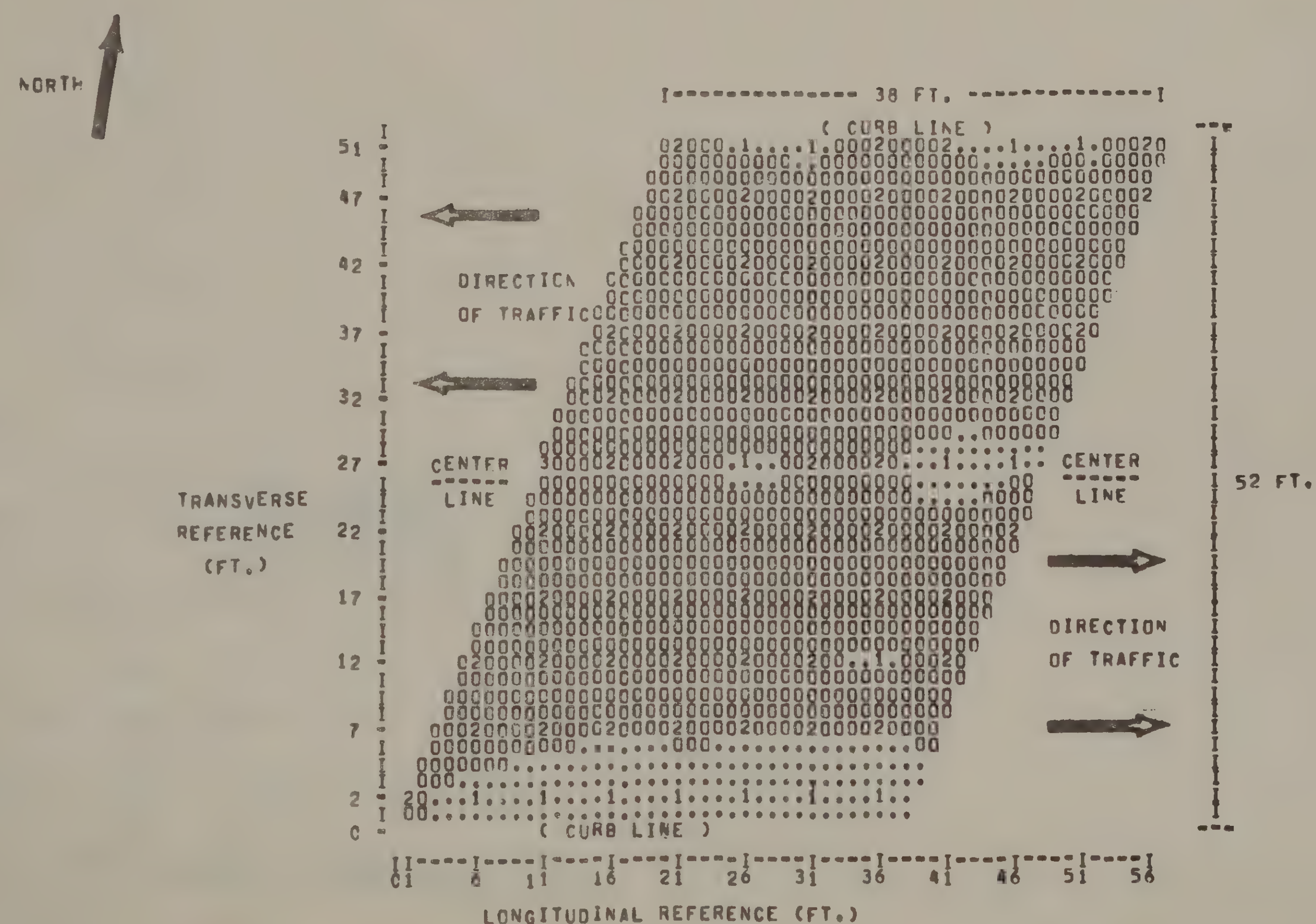


Figure 12B
Corrosion Potential Readings
1974 Survey

ARCADE TEST SITE
SPAN 1 - GALVANIZED REINFORCEMENT
SCALE 1 IN. = 10 FT.

SYMAP

```
COUNTY LINE-ARCADE   FARC 74-182   PIN 9008.00.321
SPAN NO. 1 - CORROSION POTENTIAL READINGS   9/28/76, 9/30/76


DATA VALUE EXTREMES ARE          0.11          0.36


ABSOLUTE VALUE RANGE APPLYING TO EACH LEVEL
       ("MAXIMUM" INCLUDED IN HIGHEST LEVEL ONLY)

  MINIMUM      0.00       0.20       0.36
  MAXIMUM      0.20       0.36       0.60

PERCENTAGE OF TOTAL ABSOLUTE VALUE RANGE APPLYING TO EACH LEVEL

              33.33      26.67      40.00

FREQUENCY DISTRIBUTION OF DATA POINT VALUES IN EACH LEVEL
  LEVEL          1          2          3
          ============================================
           .........  000000000  █████████
           .........  000000000  █████████
  SYMBOLS  ....1....  000020000  ████3████
           .........  000000000  █████████
           .........  000000000  █████████
          ============================================
  FREQ.         15         68          1
```

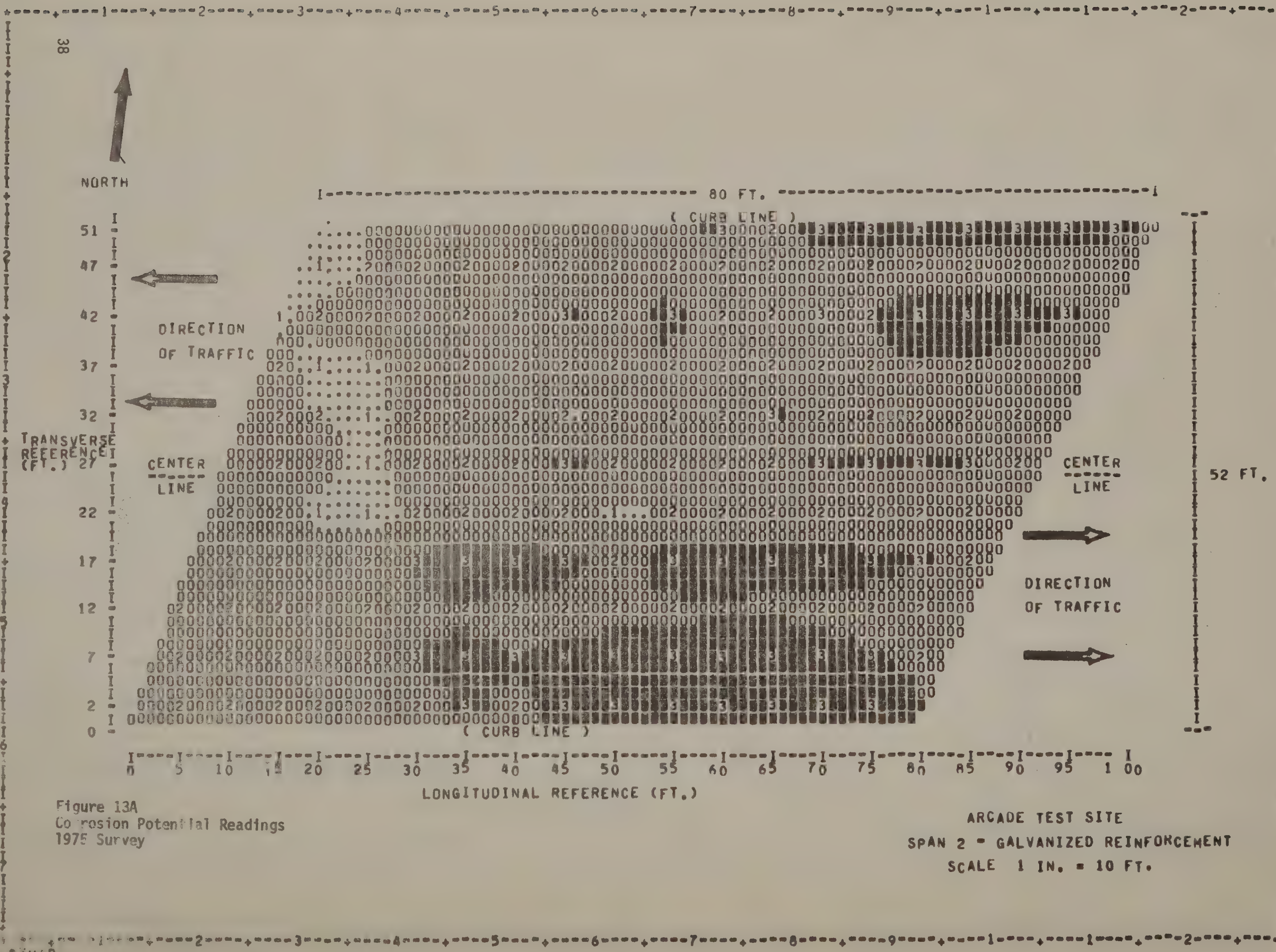


Figure 13A
Corrosion Potential Readings
1975 Survey

```
COUNTY LINE-ARCADE   FARC 74-182   PIN 4008.00.321
SPAN NO. 2 - CORROSION POTENTIAL READINGS   9/30/75


DATA VALUE EXTREMES ARE          0.14         0.50


ABSOLUTE VALUE RANGE APPLYING TO EACH LEVEL
       ("MAXIMUM" INCLUDED IN HIGHEST LEVEL ONLY)

  MINIMUM       0.00       0.20       0.36
  MAXIMUM       0.20       0.36       0.60

PERCENTAGE OF TOTAL ABSOLUTE VALUE RANGE APPLYING TO EACH LEVEL

               33.33      26.67      40.00

FREQUENCY DISTRIBUTION OF DATA POINT VALUES IN EACH LEVEL
  LEVEL           1          2          3
          ===============================
           .........  000000000  █████████
           .........  000000000  █████████
  SYMBOLS  ....1....  000020000  ████3████
           .........  000000000  █████████
           .........  000000000  █████████
          ===============================
  FREQ.           9        113         49
```

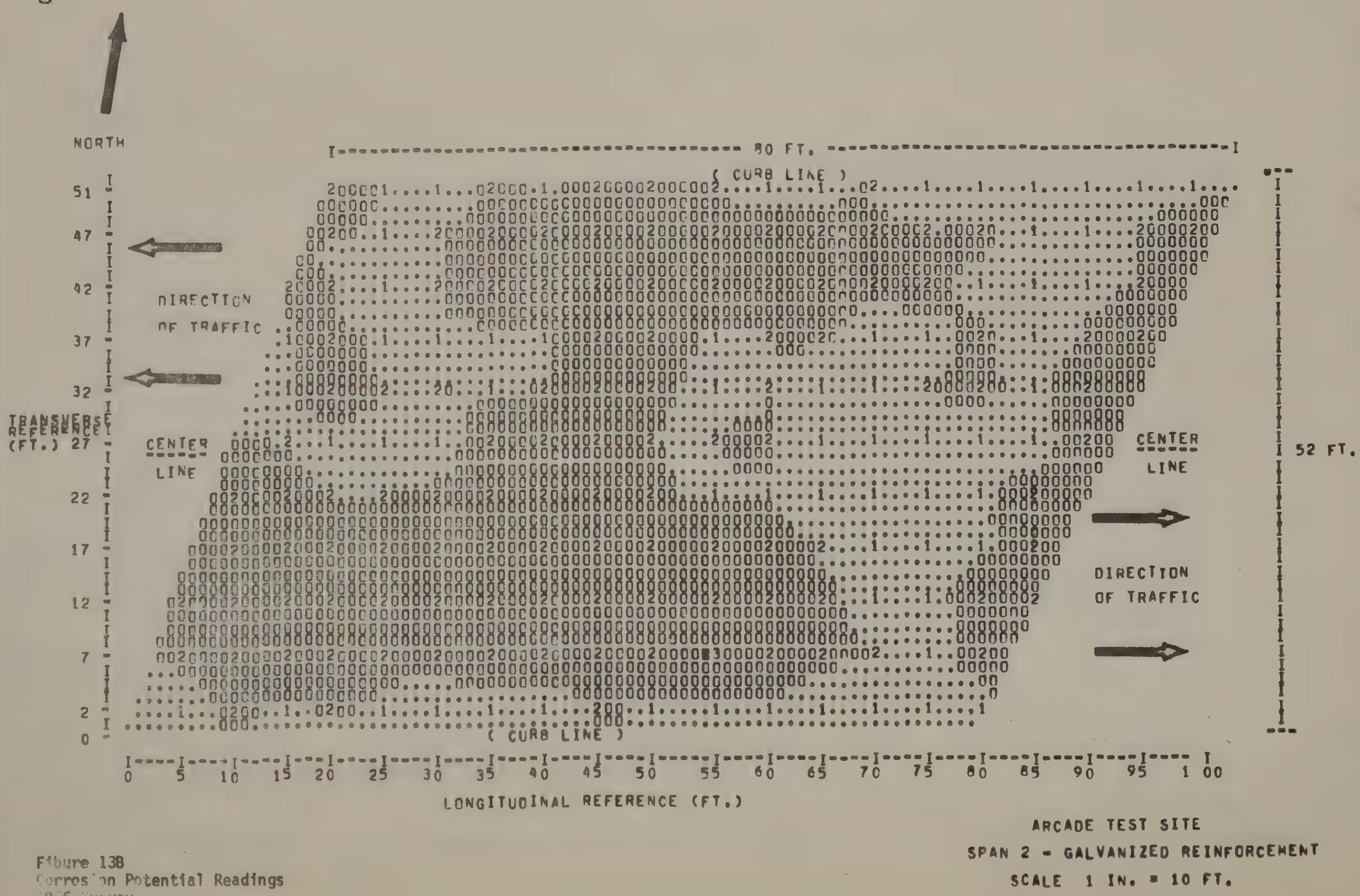


Figure 13B
Corrosion Potential Readings
1976 Survey

```
CCUNTY LINE-ARCADE   FARC 74-122   PIN 4008.00.321
SPAN NO. 2 - CORROSION POTENTIAL READINGS   9/28/76, 9/29/76


DATA VALUE EXTREMES ARE          0.01          0.36


ABSOLUTE VALUE RANGE APPLYING TO EACH LEVEL
        (*MAXIMUM* INCLUDED IN HIGHEST LEVEL ONLY)

  MINIMUM      0.00       0.20       0.36
  MAXIMUM      0.20       0.36       0.60

PERCENTAGE OF TOTAL ABSOLUTE VALUE RANGE APPLYING TO EACH LEVEL

              33.33      26.67      40.00

FREQUENCY DISTRIBUTION OF DATA POINT VALUES IN EACH LEVEL
  LEVEL          1          2          3
          ================================
          .........  000000000  █████████
          .........  000000000  █████████
  SYMBOLS ....1....  000020000  ████3████
          .........  000000000  █████████
          .........  000000000  █████████
          ================================
  FREQ.         66        114          1
```

B. Measurement Frequency

Figures 14 and 15 illustrate the change and passivation of the galvanized reinforcement. Referring to Figure 14 only one data point on Span 1 showed a higher corrosion potential in 1976. This one value changed from the 0-0.19 v. to the 0.20-0.35 v. corrosion interval. Sixty (60) measurements stayed in the same corrosion interval (0.20-0.35 v.) in both surveys. The passivation of galvanized steel on Span 1 is shown by the nineteen measurements that decreased from a higher to a lower corrosion interval in 1976 (four from the >0.35 v. to the 0.20 to 0.35 v.interval; three from the >0.35 v. and twelve from the 0.20-0.35 v. intervals to the lower 0-0.19 v. corrosion potential interval). It should be noted that the maximum measurement of 0.36 v., recorded on Span 1 in 1976 is not included in the analysis. Due to construction activity this one data point was not measured in the 1975 evaluation.

Examination of Figure 15 shows the passivation on Span 2. Only seven measurements showed higher corrosion potential values in 1976; seventy-nine measurements stayed in the same interval; and the passivation is due to a total of eighty-two measurements that moved from higher to lower corrosion intervals.

FIGURE 14 - FREQUENCY MEASUREMENT ANALYSIS
SPAN 1 - GALVANIZED REINFORCEMENT

1975 Corrosion Potentials (Number of Measured Values in Interval) / 1976 Corrosion Potential (Number of measured values in Interval)

	0-0.19 v.	0.20-0.35 v	>0.35 v.	1975 Total # Meas.
0-0.19 v.	0	1	0	
0.20-0.35 v.	12	60	0	72
> 0.35 v.	3	4	0	7
1976 Total # Meas.	15	65	0	

FIGURE 15 - FREQUENCY MEASUREMENT ANALYSIS
SPAN 2 - GALVANIZED REINFORCEMENT

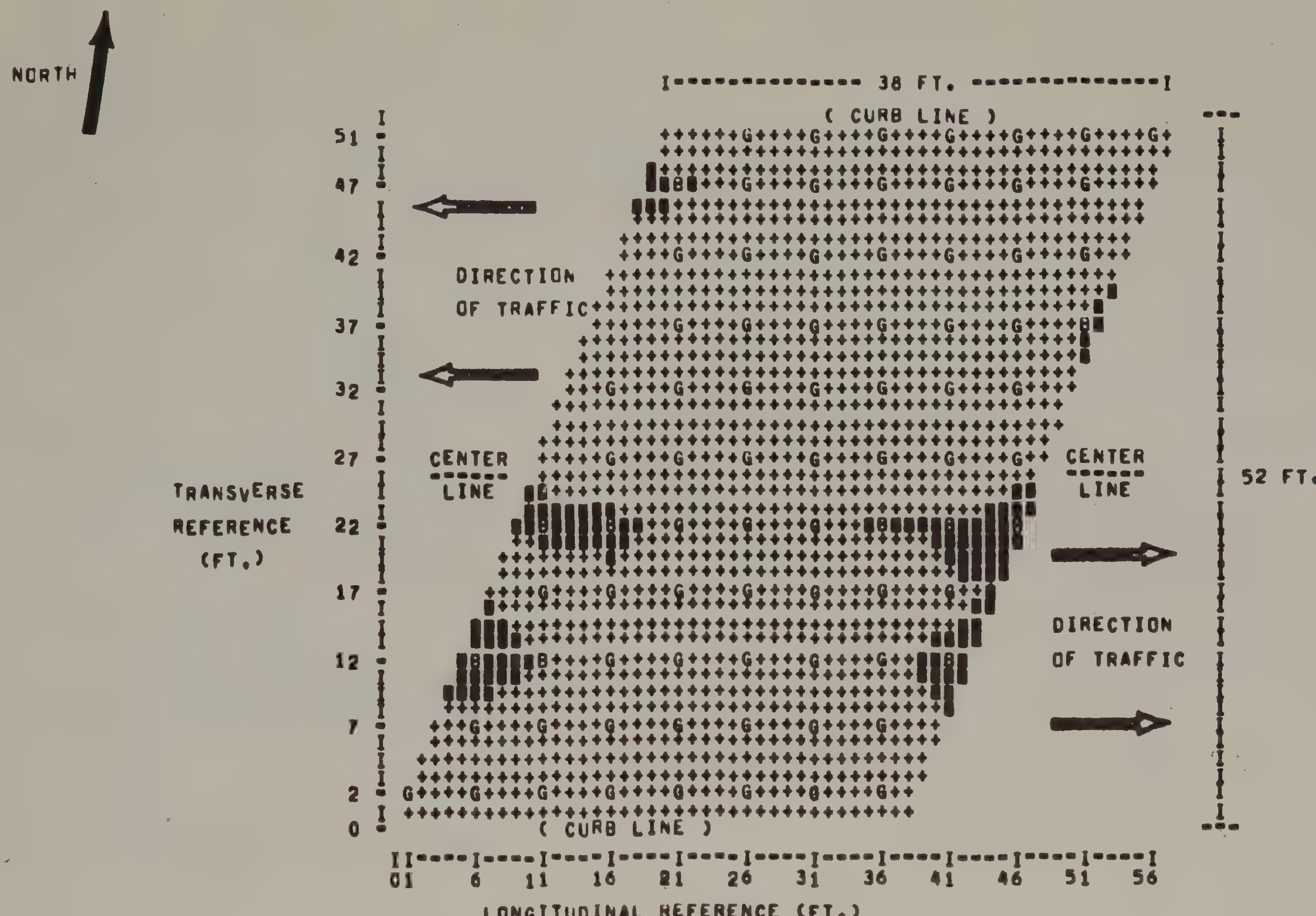
1975 Corrosion Potentials (Number of Measured Values In Interval) / 1976 Corrosion Potential (Number of Measured Values in Interval)

	0-0.19 v.	0.20-0.35 v	>0.35 v.	1975 Total # Meas.
0-0.19 v.	2	7	0	9
0.20-0.35 v.	34	79	0	113
> 0.35 v.	26	22	1	49
1976 Total # Meas.	62	108	1	

C. Corrosion Potential Difference

Figures 16 and 17 are corrosion potential difference plots for Spans 1 and 2. These maps show areas of corrosion activity as good (76-75 diff. $\leq$ 0), or bad (76-75 diff. $>$0). Examination of Figure 16 (Span 1) shows that most of the span area is plotted as good. This again illustrates the passivation of the galvanized reinforcement. The plotting data shows that seventy points in 1976 had the same or lower corrosion potentials than 1975, while only ten points showed increases in 1976. It should also be noted that the majority of bad areas are at the ends of the span. The bridge joints on this structure are steel faced and may be influencing the "end of span" measurements.

Figure 17 shows the potential difference plot for Span 2. Again the lower corrosion potentials in 1976 are evidenced by the majority of good area. The 76-75 difference was $\leq$0 for 149 measurement points while only twenty-two values showed increased corrosion potentials.



ARCADE TEST SITE
SPAN 1 - GALVANIZED REINFORCEMENT
SCALE 1 IN. = 10 FT.

Figure 16
Corrosion Potential Difference
(1976-1975)

SYMAP

```
COUNTY LINE-ARCADE   FARC 74-182   PIN 4008.00.321
SPAN NO. 1 - DIFFERENCE PLOT   1976 - 1975 )


DATA VALUE EXTREMES ARE          -0.21          0.14


ABSOLUTE VALUE RANGE APPLYING TO EACH LEVEL
       ("MAXIMUM" INCLUDED IN HIGHEST LEVEL ONLY)

  MINIMUM      -0.40        0.01
  MAXIMUM       0.01        0.20

PERCENTAGE OF TOTAL ABSOLUTE VALUE RANGE APPLYING TO EACH LEVEL

               67.50       32.50

FREQUENCY DISTRIBUTION OF DATA POINT VALUES IN EACH LEVEL
  LEVEL     ======1=========2======
             +++++++++
             +++++++++
  SYMBOLS    ++++G++++
             +++++++++
             +++++++++
            =======================
  FREQ.         70          10
```

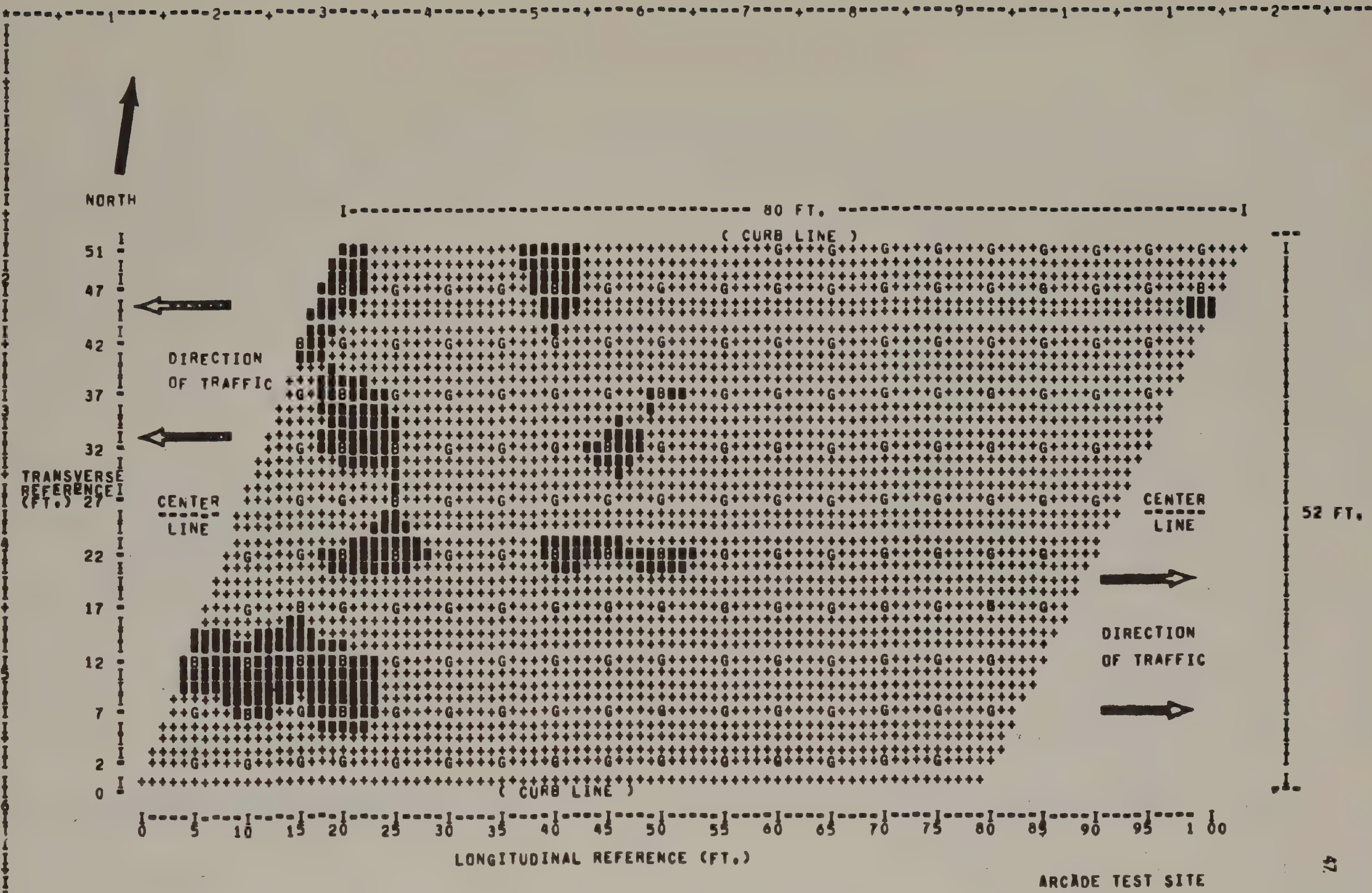


Figure 17
Corrosion Potential Difference
(1976-1975)

```
COUNTY LINE-ARCADE   FARC 74-182   PIN 4008.00.321
SPAN NO. 2 - DIFFERENCE PLOT   1976 - 1975 )



DATA VALUE EXTREMES ARE        -0.36        0.09


ABSOLUTE VALUE RANGE APPLYING TO EACH LEVEL
       ("MAXIMUM" INCLUDED IN HIGHEST LEVEL ONLY)

  MINIMUM      -0.40       0.01
  MAXIMUM       0.01       0.20

PERCENTAGE OF TOTAL ABSOLUTE VALUE RANGE APPLYING TO EACH LEVEL

              67.50      32.50

FREQUENCY DISTRIBUTION OF DATA POINT VALUES IN EACH LEVEL
  LEVEL    ========1==========2=====
            +++++++++
            +++++++++
  SYMBOLS   ++++G++++
            +++++++++
            +++++++++
           =========================
  FREQ.       149          22
```

2. Epoxy Coated Reinforcement Bars

A. Contour Maps

Figure 18 (a & b) show the corrosion potential contours for the epoxy coated bars on Span 3. The 1975 contour map shows the corrosion potentials as being generally uniform in the 0-0.19 v. interval. The 1976 map shows a similar uniformity, except at the slab ends where there is increased corrosion activity (0.20-0.35 v. interval). This increase may be due to measurements made near the steel faced bridge joints. The contour map data for 1976 shows that 160 measurements were in the 0-0.19 v. interval; and that twenty values were recorded in the 0.20-0.35 v. range. The maximum measurement was 0.29 v. After one year, all corrosion potential values are below the threshold value (>0.35 v.) and active corrosion of the epoxy coated reinforcement bars is not indicated.

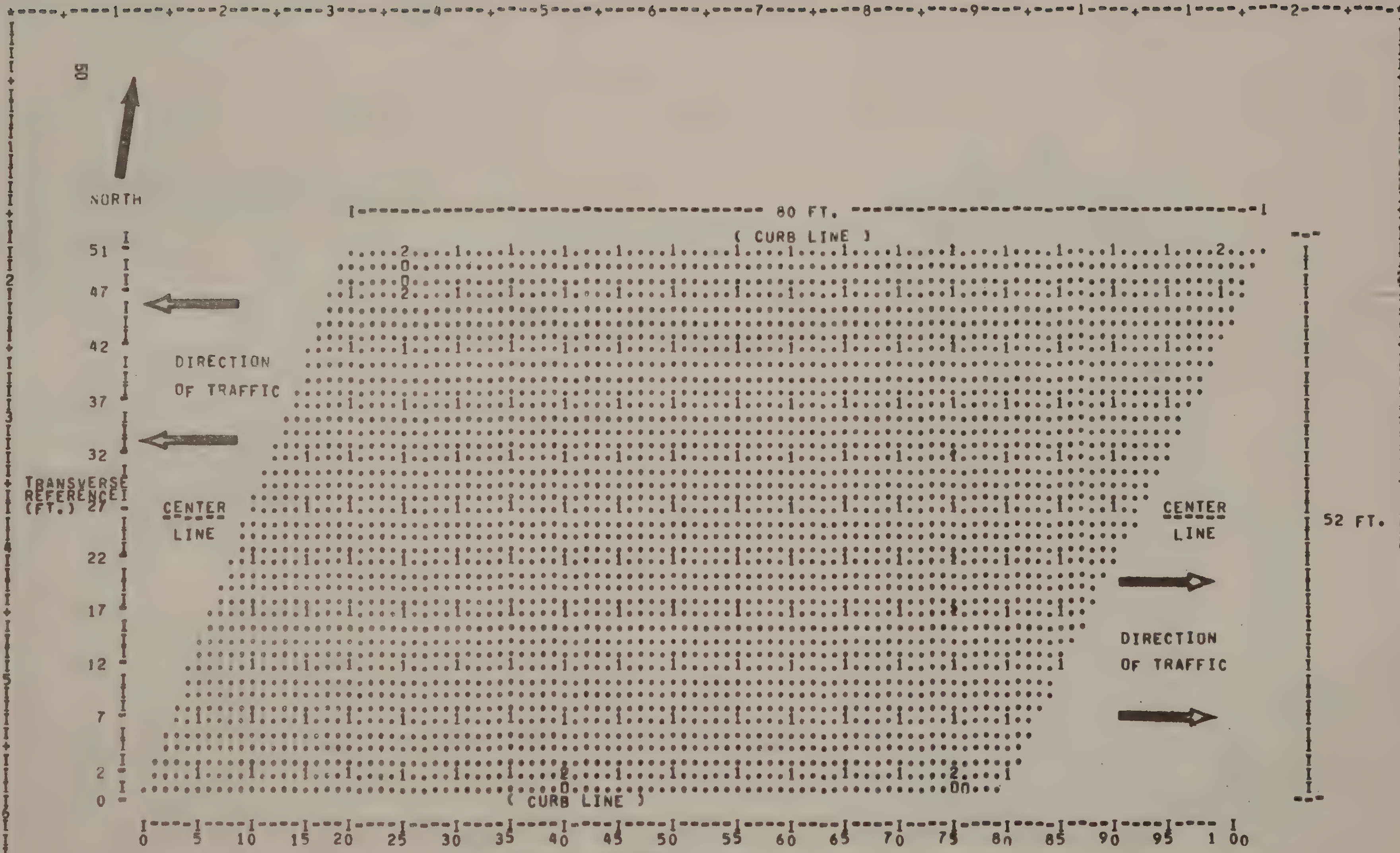


Figure 18A
Corrosion Potential Readings
1975 Survey

ARCADE TEST SITE
SPAN 3 - EPOXY COATED REINFORCEMENT
SCALE 1 IN. = 10 FT.

COUNTY LINE-ARCADE   FARC 74-182   PIN 4008.00.321
SPAN NO. 3 - CORROSION POTENTIAL READINGS 10/2/75

DATA VALUE EXTREMES ARE   0.02   0.20

ABSOLUTE VALUE RANGE APPLYING TO EACH LEVEL
("MAXIMUM" INCLUDED IN HIGHEST LEVEL ONLY)

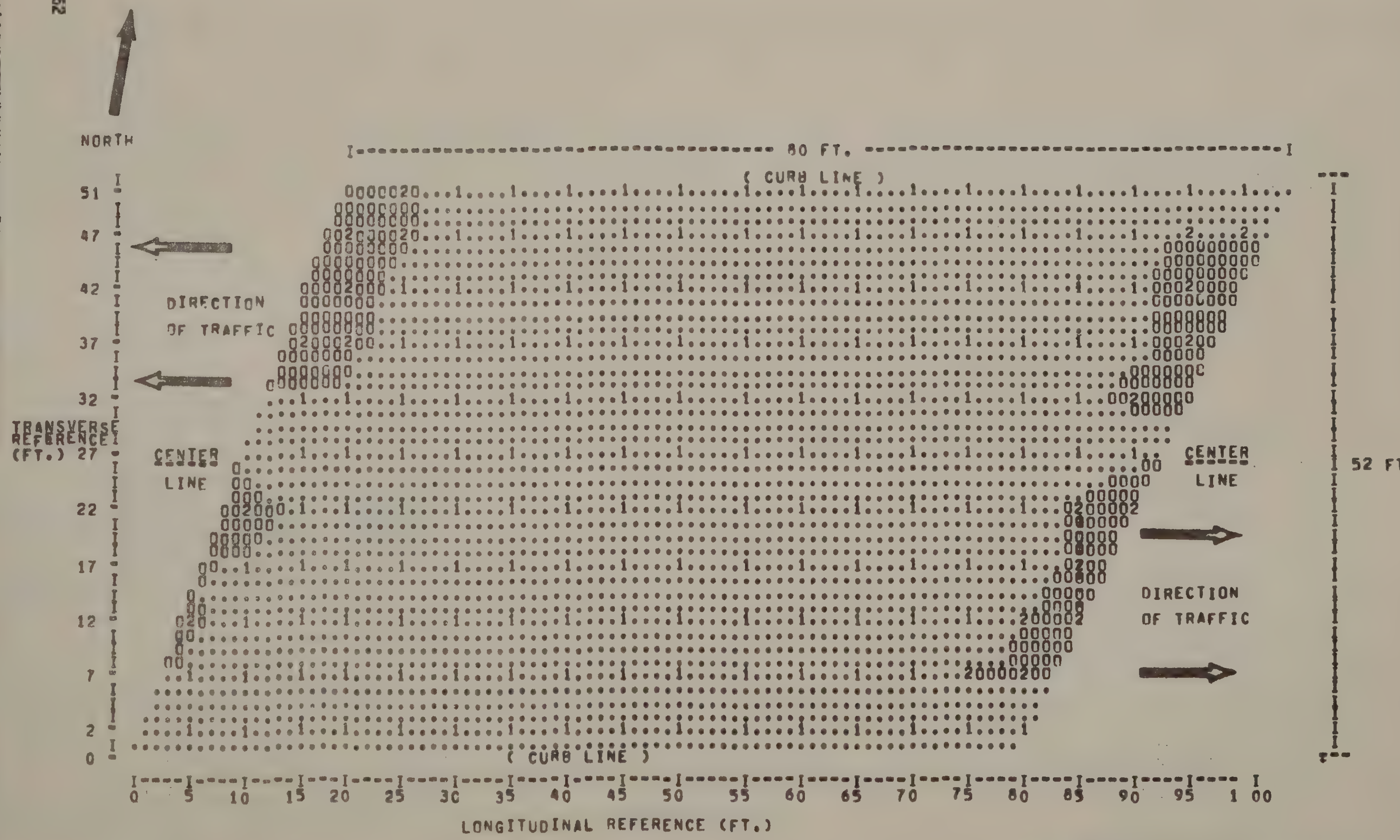
MINIMUM	0.00	0.20	0.36
MAXIMUM	0.20	0.36	0.60

PERCENTAGE OF TOTAL ABSOLUTE VALUE RANGE APPLYING TO EACH LEVEL

	33.33	26.67	40.00

FREQUENCY DISTRIBUTION OF DATA POINT VALUES IN EACH LEVEL

```
LEVEL          1          2          3
        ================================
        .........  000000000
        .........  000000000
SYMBOLS ....1....  000020000
        .........  000000000
        .........  000000000
        ================================
FREQ.     172          5          0
```



ARCADE TEST SITE
SPAN 3 - EPOXY COATED REINFORCEMENT
SCALE 1 IN. = 10 FT.

Figure [illegible]
Corrosion Potential Readings
1976 Survey

```
COUNTY LINE-ARCADE   FARC 74-182   PIN 4008.00.321
SPAN NO. 3 - CORROSION POTENTIAL READINGS   9/28/76, 9/30/76


DATA VALUE EXTREMES ARE          0.02         0.29


ABSOLUTE VALUE RANGE APPLYING TO EACH LEVEL
       ("MAXIMUM" INCLUDED IN HIGHEST LEVEL ONLY)

  MINIMUM       0.00       0.20       0.36
  MAXIMUM       0.20       0.36       0.60

PERCENTAGE OF TOTAL ABSOLUTE VALUE RANGE APPLYING TO EACH LEVEL

              33.33      26.67      40.00

FREQUENCY DISTRIBUTION OF DATA POINT VALUES IN EACH LEVEL
  LEVEL          1          2          3
           ==============================
             .........  000000000  █████████
             .........  000000000  █████████
  SYMBOLS    ....1....  000020000  ████3████
             .........  000000000  █████████
             .........  000000000  █████████
           ==============================
  FREQ.         160         20          0
```

B. Measurement Frequency

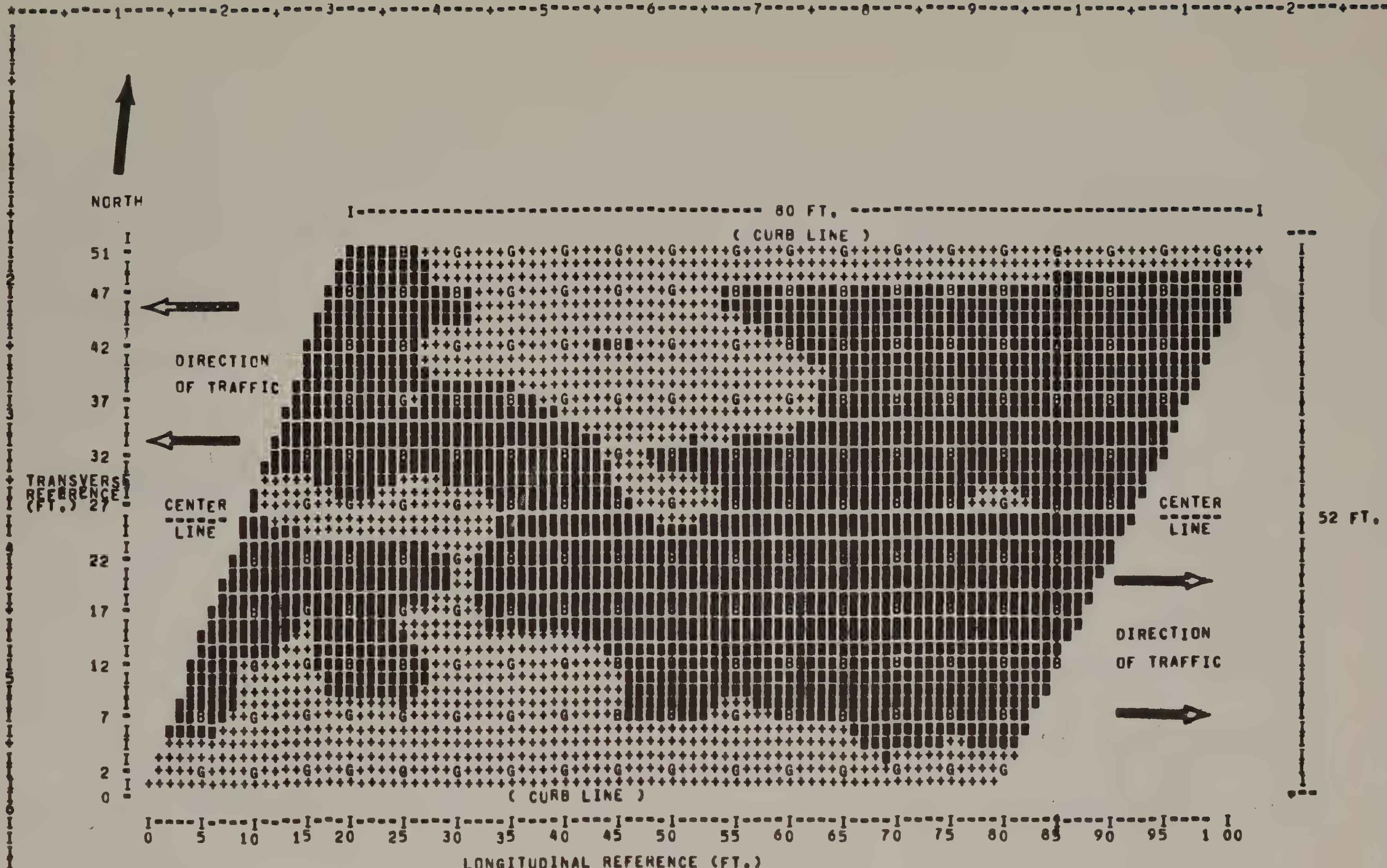
Figure 19 shows the measurement frequency data for Span 3. The uniformity of the contour maps is shown by the 156 measured values that remained in the 0-0.19 v. corrosion interval in both evaluations. The increase in corrosion activity at the slab ends is seen as the twelve values that increased to the higher 0.20-0.35 v. interval. Three measurements also decreased in 1976. In general, the data illustrates that the corrosion activity of the epoxy coated bars was not significantly changed in 1976.

FIGURE 19-MEASUREMENT FREQUENCY ANALYSIS
SPAN 3 - EPOXY COATED REINFORCEMENT

1975 Corrosion Potential (Number of Measured Values In Interval)	1976 Corrosion Potential (Number of Measured Values in Interval) 0-0.19 v.	0.20-0.35 v.	>0.35 v.	1975 Total # Meas.
0-0.19 v.	156	12	0	168
0.20-0.35 v.	3	2	0	5
> 0.35 v.	0	0	0	0
1976 Total Meas.	159	14	0	

C. Corrosion Potential Difference

Figure 20 shows the corrosion potential difference plot for the epoxy coated bars. Although other methods of analysis have indicated a stable condition, the potential difference map shows a general increase in corrosion activity. The magnitude of increase is small, as evidenced by reference to Table 2, (avg. 76-75 Diff. = 0.0047 v.). Examination of the map data shows that 107 points are plotted as bad (76-75 Diff. > 0) and seventy as good (76-75 Diff. ≤ 0). The potential difference plot may be an indicator of future areas of corrosion, but since the magnitude of increase is small, it is not significant at the present time.



ARCADE TEST SITE

SPAN 3 - EPOXY COATED REINFORCEMENT

SCALE 1 IN. = 10 FT.

Figure 20
Corrosion Potential Difference
(1976-1975)

```
COUNTY LINE-ARCADE   FAR: 74-182   PIN 4008.00.321
SPAN NO. 3 - DIFFERENCE PLOT   1976 - 1975 )



DATA VALUE EXTREMES ARE        -0.15        0.15


ABSOLUTE VALUE RANGE APPLYING TO EACH LEVEL
      ("MAXIMUM" INCLUDED IN HIGHEST LEVEL ONLY)

  MINIMUM      -0.40      0.0
  MAXIMUM       0.01      0.2

PERCENTAGE OF TOTAL ABSOLUTE VALUE RANGE APPLYING TO EACH LEVEL

              67.50      32.5

FREQUENCY DISTRIBUTION OF DATA POINT VALUES IN EACH LEVEL
  LEVEL             1             2
           ==========================
            +++++++++
            +++++++++
  SYMBOLS   ++++G++++
            +++++++++
            +++++++++
           ==========================
  FREQ.        70            107
```

3. Uncoated Reinforcement Bars

A. Contour Maps

The uncoated reinforcement bars in Span 4, are shown in Figure 21 (a & b). Figure 21a (1975) shows no corrosion activity; all data values except one are in the 0-0.20 v. corrosion potential interval. Examination of Figure 21b, shows the same type of plot, which indicates that the plain bars are performing satisfactorily after one year of service. (Note: Figure 21b shows an area coded as "L." This represents seven field measurements which showed the reinforcing steel to be at a higher potential (more positive) than the Cu-CuSO4 half-cell. For interpretation in this report, these points are considered as indicative of no active corrosion;(corrosion potential $<$ 0.20 v.).

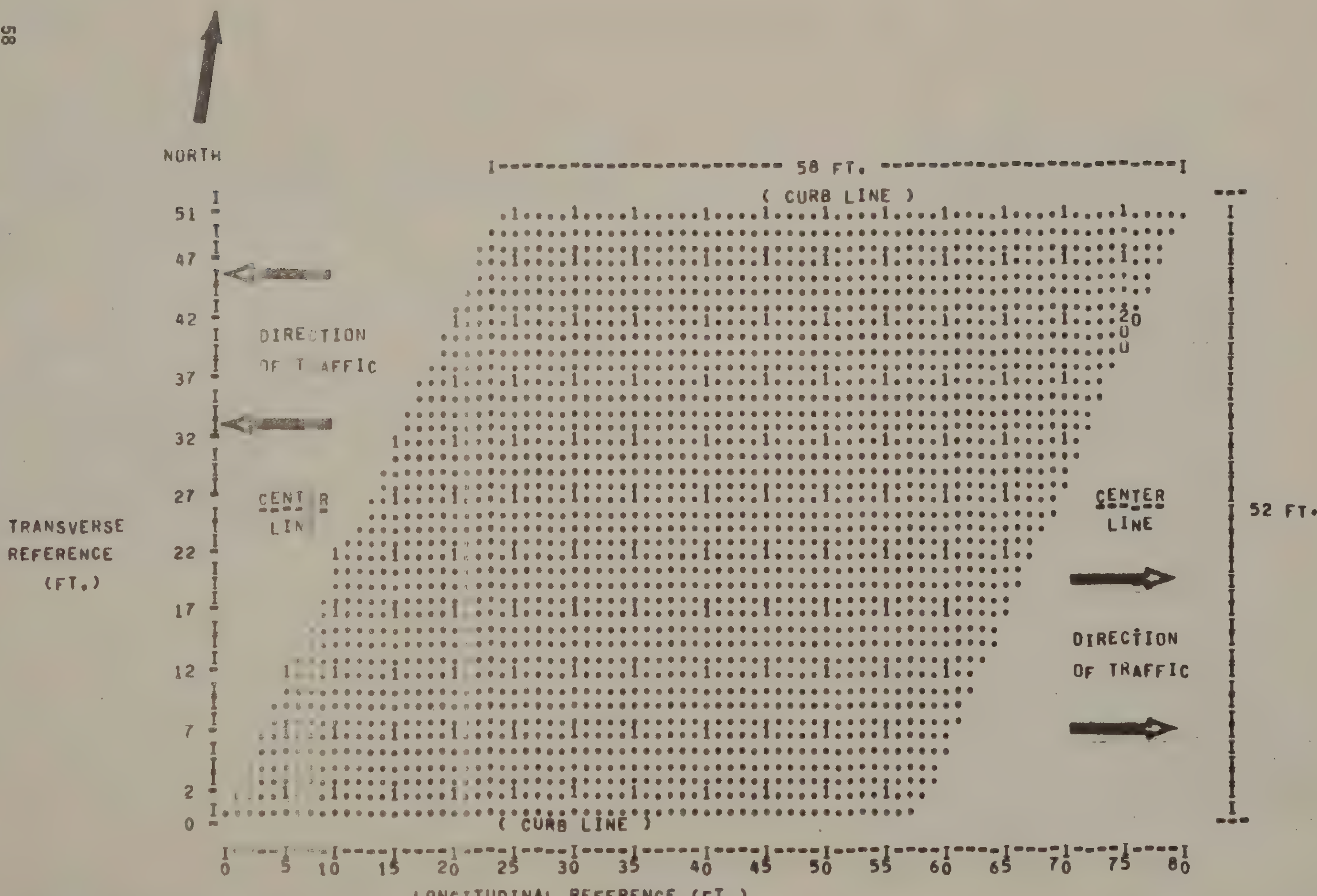
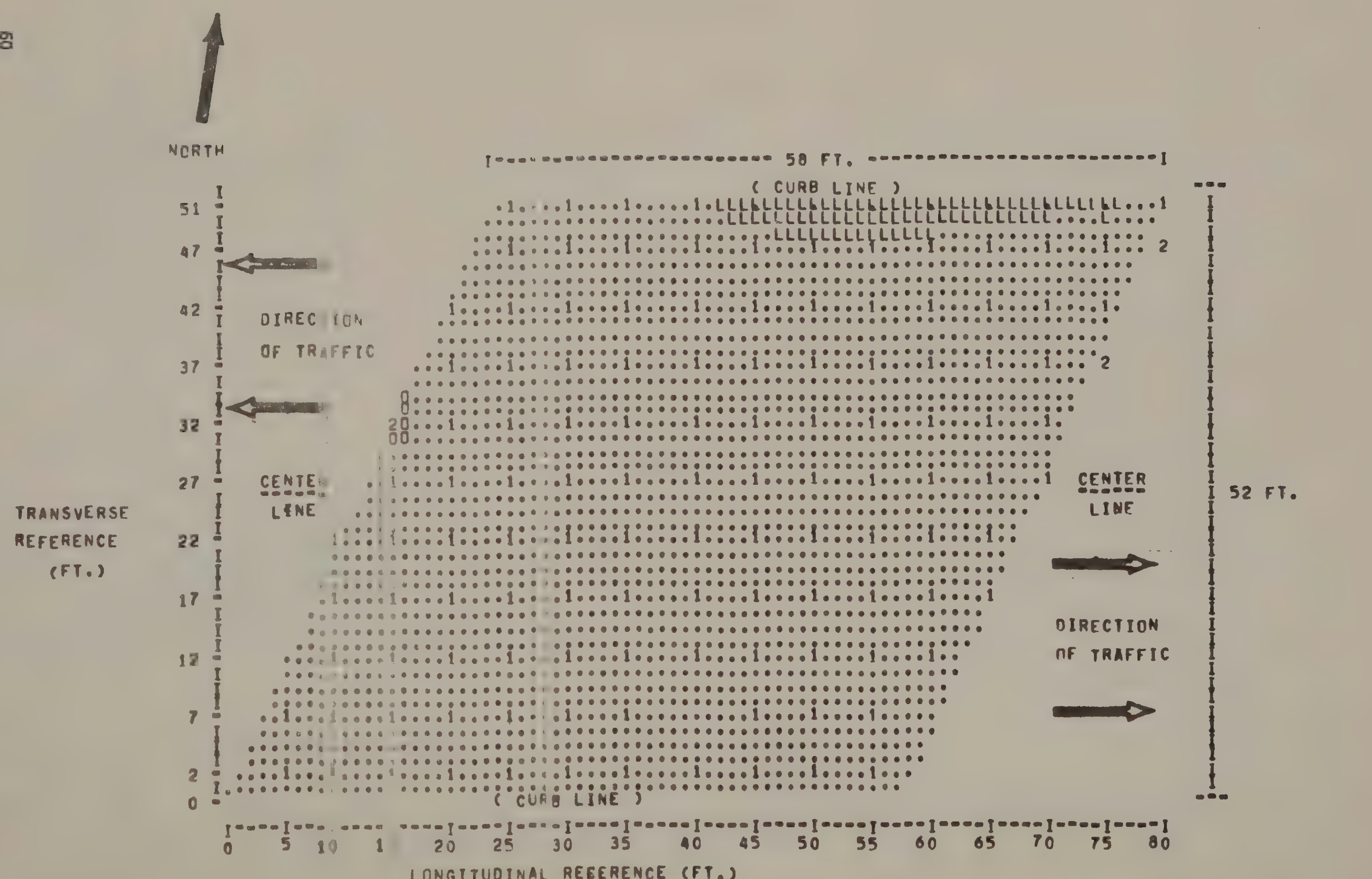


Figure 21A
Corrosion Potential Readings
1975 Survey

ARCADE TEST SITE
SPAN 4 - UNCOATED REINFORCEMENT
SCALE 1 IN. = 10 FT.

SYMAP

```
COUNTY LINE-ARCADE   FARC 74-132   PIN 4008.00.321
SPAN NO. 4 - CORROSION POTENTIAL READINGS  10/9/75



DATA VALUE EXTREMES ARE          0.06         0.20


ABSOLUTE VALUE RANGE APPLYING TO EACH LEVEL
       ("MAXIMUM" INCLUDED IN HIGHEST LEVEL ONLY)

  MINIMUM      0.00        0.20        0.36
  MAXIMUM      0.20        0.36        0.60

PERCENTAGE OF TOTAL ABSOLUTE VALUE RANGE APPLYING TO EACH LEVEL

               33.33       26.67       40.00

FREQUENCY DISTRIBUTION OF DATA POINT VALUES IN EACH LEVEL
  LEVEL         1           2           3
          ===================================
           .........  000000000
           .........  000000000
  SYMBOLS  ....1....  000020000      3
           .........  000000000
           .........  000000000
          ===================================
  FREQ.       124           1           0
```



ARCADE TEST SITE
SPAN 4 - UNCOATED REINFORCEMENT
SCALE 1 IN. = 10 FT.

Figure 21B
Corrosion Potential Measuremen
1976 Survey

SYMAP

```
COUNTY LINE-ARCADE   FARC 74-182   PIN 4008.00.321
SPAN NO. 4 - CORROSION POTENTIAL READINGS   9/29/74, 9/30/76



DATA VALUE EXTREMES ARE          -0.08          0.24


ABSOLUTE VALUE RANGE APPLYING TO EACH LEVEL
        ("MAXIMUM" INCLUDED IN HIGHEST LEVEL ONLY)

  MINIMUM      BELOW       0.00       0.20       0.36
  MAXIMUM       0.00       0.20       0.36       0.60

PERCENTAGE OF TOTAL ABSOLUTE VALUE RANGE APPLYING TO EACH LEVEL

                          33.33      26.67      40.00

FREQUENCY DISTRIBUTION OF DATA POINT VALUES IN EACH LEVEL
  LEVEL          L          1          2          3
           ==========================================
            LLLLLLLLL  .........  000000000  █████████
            LLLLLLLLL  .........  000000000  █████████
  SYMBOLS   LLLLLLLLL  ....1....  000020000  ████3████
            LLLLLLLLL  .........  000000000  █████████
            LLLLLLLLL  .........  000000000  █████████
           ==========================================
  FREQ.          7         118          3          0
```

B. Measurement Frequency

Figure 22 shows the measurement frequency table for the uncoated bars on Span 4. The uniformity of the contour maps can be seen from this data, which illustrates that the total number of measured values in each corrosion interval for 1976 is the same as the total for 1975.

FIGURE 22 - MEASUREMENT FREQUENCY ANALYSIS
SPAN 4 - UNCOATED REINFORCEMENT

1975 Corrosion Potential (Number of Measured Values In Interval)	1976 Corrosion Potential (Number of Measured Values in Interval) 0-0.19 v.	0.20-0.35 v	>0.35 v.	1975 Total # Meas.
0-0.19 v.	121	1	0	122
0.20 0.35 v.	1	0	0	1
> 0.35 v.	0	0	0	0
1976 Total Meas.	122	1	0	

C. Corrosion Potential Difference

Figure 23 is the corrosion potential difference plot for the uncoated reinforcement bars. This map shows that approximately half of the slab area had increased corrosion activity in 1976 (sixty-five points are plotted as bad; fifty-eight good). However, the magnitude of increase is small, and Table 2 actually shows that the average corrosion potential between 1976 and 1975 surveys is reduced by 0.0077 v. This data, like that of the epoxy coated bars, may be an indicator of future areas of corrosion, but is not significant at the present time.

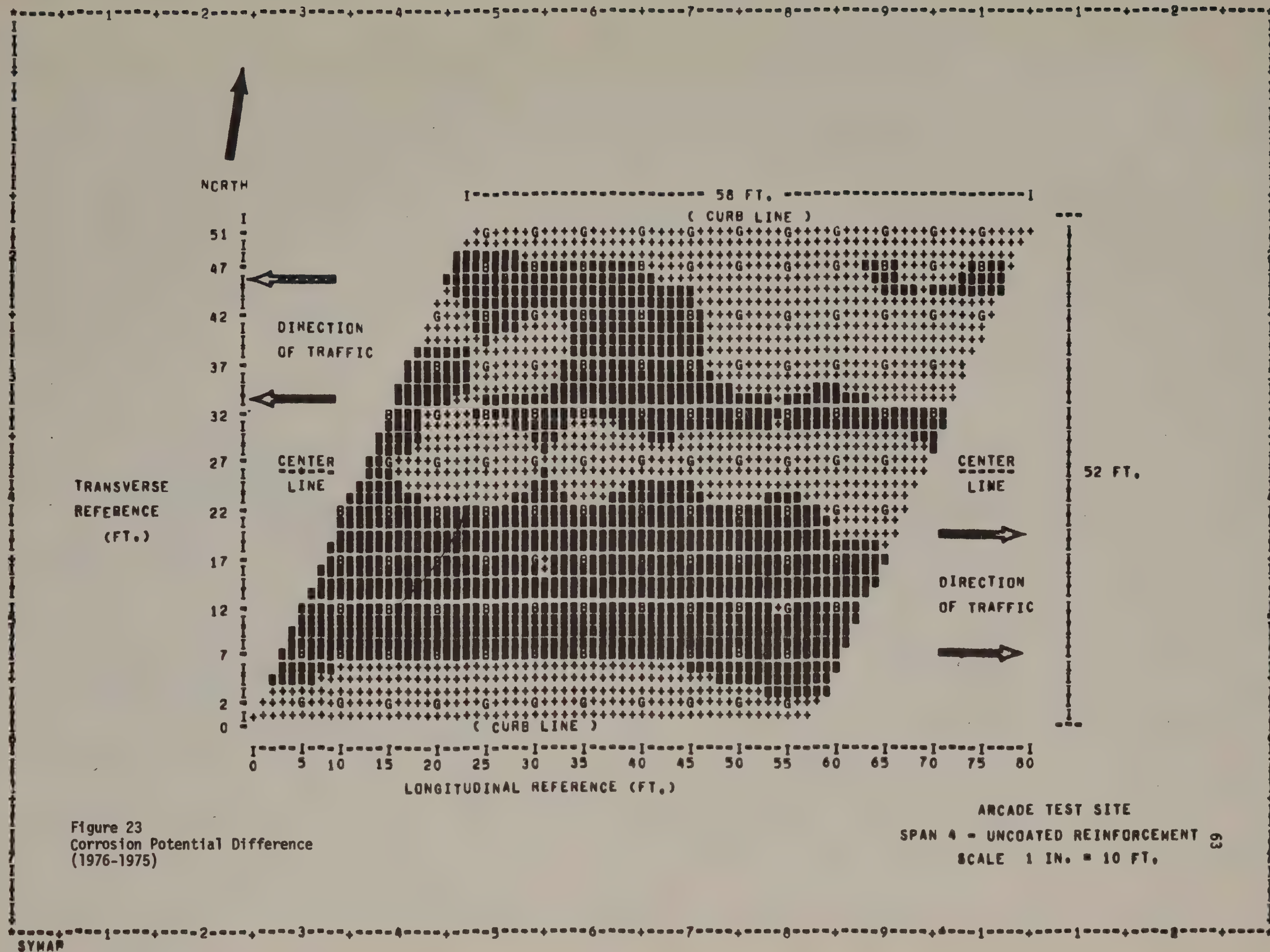


Figure 23
Corrosion Potential Difference
(1976-1975)

```
COUNTY LINE-ARCADE   FARC 74-182   PIN 4008 00.221
SPAN NO. 4 - DIFFERENCE PLOT   1976 - 1975


DATA VALUE EXTREMES ARE        -0.19        0.11


ABSOLUTE VALUE RANGE APPLYING TO EACH LEVEL
       ("MAXIMUM" INCLUDED IN HIGHEST LEVEL ONLY)

  MINIMUM      -0.40       0.01
  MAXIMUM       0.01       0.20

PERCENTAGE OF TOTAL ABSOLUTE VALUE RANGE APPLYING TO EACH LEVEL

              67.50      32.50

FREQUENCY DISTRIBUTION OF DATA POINT VALUES IN EACH LEVEL
  LEVEL     =====1==========2======
             +++++++++  █████████
             +++++++++  █████████
  SYMBOLS    ++++G++++  █████████
             +++++++++  █████████
             +++++++++  █████████
            =======================
  FREQ.         58         65
```

VIII. COST ANALYSIS

A cost analysis in terms of time-to-corrosion of the reinforcing bars is not possible in this first reporting. To provide some cost information, the installed costs of the reinforcement bars at both the Arcade and Interstate Route 88 test sites are given in Table 3. In addition, the average contract cost for uncoated bars, is shown for the construction seasons of 1969-76. The use of the uncoated bars in standard construction work was changed in October, 1976, by new design standards which specify the use of epoxy coated bars in the top reinforcing mat of monolithic bridge decks. Additional contract costs for epoxy and uncoated bars will be included in future reports. No further use of galvanized bars is anticipated at the present time.

TABLE 3 - REINFORCEMENT BAR COSTS

1. ARCADE TEST SITE

Bar Type	Total Pounds	Installed Cost ($/lb)
Uncoated	32163	0.46
Galvanized	65768	0.79
Epoxy Coated	44729	1.34

2. INTERSTATE ROUTE 88 TEST SITE

Bar Type	Total Pounds	Installed Cost($/lb.)
Uncoated	284480	0.23
Galvanized	430232	0.45
Epoxy Coated	504889	0.50

3. CONTRACT COSTS - UNCOATED REINFORCEMENT

Year	Number Contracts	Total Pounds	Avg. Installed Cost ($/lb)
1969	124	56,000,000	0.186
1970	115	58,000,000	0.239
1971	51	25,000,000	0.250
1972	121	20,000,000	0.274
1973	122	91,500,000	0.279
1974-75	126	5,500,000	0.440
1975-76	132	10,500,000	0.304

IX. SUMMARY

No problems were encountered in the shop coating and fabrication, or with the job site installation of epoxy coated and galvanized reinforcing bars. Epoxy coated bars were not severly damaged in shipment or handling and only minor field touch-up was necessary. No field repair of the galvanized reinforcing bars was needed.

The initial evaluation of the reinforcing bars that have been installed at the Interstate Route 88 test site, will be performed in Spring, 1977. The concrete bridge deck work on the structures with epoxy coated and galvanized reinforcing steel was not completed until October, 1976, and early winter weather has prevented the post-construction survey. These structures will not be opened to traffic until the latter part of 1977.

Two performance evaluations have been made at the Arcade test site; the first in 1975, before the bridge was opened to traffic and the second in 1976, after one year of service and one winter season. After one year of service all bar types are performing satisfactorily. There are no indications of active corrosion; and the chloride content at the level of the steel reinforcement is not sufficient to promote active corrosion ($<$1.3 lb. Cl^-/c.y.).

The corrosion potential data indicates that the galvanized reinforcement bars have passivated; from approximately $0.3\pm$ v. in 1975 to $0.22\pm$ v. in 1976. The corrosion potential measurements on epoxy coated bars have remained about the same in each evaluation (0.12-0.13 v.). The uncoated reinforcing bars have also remained stable, with a corrosion potential of about 0.10 v. in each survey.

X. FUTURE WORK

Future work on this study will consist of annual evaluations at each test site. The results of these inspections will be given in future reports.

ACKNOWLEDGEMENTS

This study was conducted by personnel of the Materials Bureau, Harry H. McLean, Director, under the administrative supervision of James J. Murphy, Assistant Director.

Special note is made of contributions by William H. Bregenzer, Senior Civil Engineer, Materials Bureau, who designed the data analysis and managed the computer programming.

Arrangements for the test sites, technical advice and personnel assistance were supplied by the Structures Design and Construction Subdivision. From this unit, the special efforts of Daniel E. Feeser, Assistant Civil Engineer, are appreciated.

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3. Crumpton, C. F. and Bukovatz, J. E., "Corrosion and Kansas Bridges." Transportation Research Record 500, TRB, pp 25-31.

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APPENDIX A

SPECIFICATIONS FOR GALVANIZED REINFORCEMENT BARS

BAR REINFORCEMENT FOR STRUCTURES (GALVANIZED)

1. DESCRIPTION:

   This work shall consist of furnishing and placing galvanized reinforcing steel for structures in accordance with the Contract Plans in a manner satisfactory to the Engineer.

2. MATERIALS:

   A. Reinforcing Steel:

      The material for the reinforcing steel shall meet the requirements of ASTM A-615, Grade 60.

   B. Zinc Coating (Galvanizing)

      1.0 Coating Material. The zinc used for the coating shall meet the requirements of ASTM Specification B6 for Zinc Metal (Slab Zinc) and shall be at least equal to the grade designated as "Prime Western."

      2.0 Coating Process. The zinc coating shall be applied by the hot dipping method meeting the requirements of ASTM Specification A-123 Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed and Forged Steel Shapes, Plates, Bars and Strip.

      3.0 Quenching. The reinforcing bars shall be quenched as soon as possible after galvanizing. Quenching may be combined with chromate treatment as indicated in the subsection for Chromate Treatment.

      4.0 Chromate Treatment. The galvanized reinforcement bars shall be chromate treated. If the chromate treatment is performed immediately after galvanizing it may be accomplished by means of quenching the reinforcement bars in a solution containing at least 0.2% by weight of sodium dichromate in water. (i.e. 3 oz. for each 10-gal. of quench water) or by quench chromating in a minimum 0.2% chromic acid solution. The solution shall be at least $90^{o}F$. The galvanized reinforcing bars shall be immersed in the solution for at least 20 seconds. If the galvanized reinforcement bars have cooled to ambient temperature the chromate treatment shall be the same as specified above except that 0.5 to 1.0% concentration of sulfuric acid shall be added as an activator to the chromate solution.

5.0 Lot Size. For test purposes a lot is the smallest number of reinforcing bars of the same type, heat and size as determined by the following requirements:

a. A lot shall not exceed a single order or delivered load, whichever is smaller.

b. A lot shall consist of the number of bars as defined by the coating applicator except that it shall not exceed the number of reinforcing bars coated within a single shift.

6.0 Embrittlement of Steel. To safeguard against embrittlement, the galvanized reinforcing bars furnished under this specification shall be prepared for galvanizing in conformance with the practice and guidelines of ASTM A-143.

Each lot of bars shall be tested for embrittlement by the coating manufacturer. The embirttlement test shall consist of bending a coated test specimen 180^{o} and shall be performed according to the bend test described in ASTM A-615. For each lot of galvanized bars one test specimen shall be prepared and tested. The test specimen may be any convenient length, but shall be of the same heat and have the same diameter as the lot of reinforcing bars it represents. The bend test specimen shall be galvanized, quenched and chromate treated at the same time and in the same manner as the general lot of reinforcing bars. After galvanizing, the coated test specimen shall be bent 180^{o} around a pin. The galvanized bar is to be bent at ambient temperature, but in no case less than 60^{o}F (16^{o}C), and the pin sizes are given in Table 1. If the test specimen cracks or otherwise fails this bend test, the lot it represents shall be considered to be embrittled and shall be rejected. Flaking, spalling or cracking of the galvanized coating is not to be construed as an embrittlement failure.

TABLE 1 - PIN SIZES (GRADE 60 BARS)

BAR DESIGNATION NO.	PIN DIAMETER FOR BEND TEST (d = nominal diameter of specimen)
3,4,5	4d
6	5d
7,8	6d
9,10,11	8d

7.0 Weight of Coating. The weight of the zinc coating shall average not less than 2.3 oz./sq.ft. and no individual measurement shall show less than 2.0 oz./sq.ft. The average coating weight may be determined by magnetic thickness gauge measurements conducted on a representative number of bars from each production lot in accordance with ASTM Recommended Practice E-376 Measuring Coating Thickness by Magnetic Field or Eddy-Current (Electromagnetic) Test Methods.

8.0 Fabrication. The reinforcement bars shall be galvanized after fabrication in accordance with the drawings. It is the responsibility of the Contractor to coordinate the tagging and identification requirements for the project and to provide a non-destructable metal tag system.

9.0 Coating Repair Method. When a coated reinforcement bar suffers minor damage during shipment and/or construction, field repairs shall be made in accordance with Subsection 719-01 Galvanized Coatings and Repair Methods.* Field repairs must be made when the area of coating damage is greater than the cross-sectional area of the reinforcement bar. Shop repairs are not allowed. Bars damaged during coating application must be stripped and regalvanized before their use.

10.0 Plant Inspection. The coating applicator shall be responsible for performing quality control and all specified tests on galvanized reinforcement bars.

However, the Department reserves the right to have its authorized representative observe the preparation, coating and testing of the reinforcement bars. To accomplish this, the coating applicator (or Contractor) shall notify the Regional Construction Office and the Materials Bureau, in writing, 30 days prior to the beginning of any coating application. The Department's representative shall have free access to the plant and any work done when access has been denied, shall be automatically rejected.

If the representative elects, lengths of coated bars may be taken from the production run, on a random basis, for test, evaluation and check purposes in the Materials Bureau.

* Section 719-01, specifies approved zinc rich paint materials.

11.0 Basis of Acceptance. The coating applicator shall furnish a Certificate of Compliance with each shipment of galvanized bars. The Certificate of Compliance shall state that a representative sample of galvanized bars has been tested in accordance with the terms of this specification and that the results conform to the requirements of this specification.

The Certificate of Compliance and all documentation required by Subsection 710.01, Bar Reinforcement for Cement Concrete, shall accompany each shipment to the work site.

3. CONSTRUCTION DETAILS:

A. Placing and Fastening Galvanized Reinforcing Steel

Prior to placing galvanized reinforcement steel, all grease, dirt, mortar, wet storage stains (white rust) and any other foreign substance must be removed from the galvanized reinforcement steel. After removal of these deposits the coating shall have a uniform appearance free from uncoated spots, lumps, blisters, gritty areas, acid flux and black spots. Materials with these defects will be rejected and immediately removed from the work site. Acceptable material will be provided to replace rejected material at no additional expense to the State.

The steel reinforcement shall be placed in the position indicated and within the allowable tolerances specified. However, the galvanized reinforcement steel shall not be electrically coupled to unprotected steel or other dissimilar metals. Bar supports shall be plastic coated with a di-electric material. Tie wire shall be annealed wire 16-gage or heavier and galvanized. Polyethylene or a similar di-electric tape shall be used to provide local insulation between dissimilar metals that would otherwise be in contact. Before concrete is placed, all reinforcement shall be securely fastened and supported with the approved material and by the methods herein described.

B. Inspection.

Concrete shall not be placed until the galvanized reinforcing steel is inspected and permission for placing concrete is granted by the Engineer. All concrete placed in violation of this provision shall be rejected and removed.

C. Bar Reinforcement.

1.0 Ordering. Prior to ordering reinforcing steel the Contractor shall carefully check all bar lists and assume full responsibility for their accuracy. No changes in the bar list shall be made by the Contractor unless approved by the Deputy Chief Engineer (Structures).

2.0 Field Bending. No field bending will be permitted. The reinforcement shall be shop bent to the shapes shown on the plans and then galvanized. Unless shown otherwise on the plans, the radii of bends, measured to the inside face of the bent bar, shall be equal to or greater than three times the diameter of the bar. Bends in stirrups shall be equal to or greater than the diameter of the bars.

3.0 Splices. Splices shall be permitted only where shown on the Contract Plans. Should the Contractor desire to splice bars at locations other than those shown on the Contract Plans, he shall first obtain written permission to do so from the Deputy Chief Engineer (Structures). Such permitted splices shall be well distributed or located at points of low tensile stress. Splices shall not be permitted unless a minimum clearance of two inches can be provided between the spliced bar and the nearest adjacent bar. Splices shall be made by placing the bars in contact and wiring them together for the full length of the splice with galvanized tie wire. Other types of positive connections shall develop in tension, at least 90% of the specified minimum tensile strength of the reinforcing bar. Proposed methods and details for positive connected splices shall be submitted to the Deputy Chief Engineer (Structures) for approval.

4.0 Placement in Bridge Slabs. Bar supports shall be spaced no farther apart than 4'-0" center-to-center, nor shall they be closer than 6" from the edge of any future concrete surface. Bridge slab bar reinforcement shall be placed in accordance with the following tolerances.

Vertical - $\pm$ 1/4"
Horizontal - $\pm$ 1/2"

The bridge slab reinforcing bar mats (top and bottom) shall be securely connected together. This connection may be accomplished by wiring or other means approved by the Engineer. Connections shall be placed no farther apart than four feet on center. The bar supports may be utilized for this purpose. Connecting devices shall neither deflect the bar reinforcement nor interfere with the smooth flow of concrete.

Concrete shall not be placed until the galvanized reinforcing steel is inspected and permission for placing concrete is granted by the Engineer. All concrete placed in violation of this provision shall be rejected and removed at the expense of the Contractor.

Verification. Immediately subsequent to the placement of concrete, the Engineer shall verify at random that the vertical clear distance from the top of slab to the top mat of main reinforcing, as shown on the Contract Plans, is correct within the tolerances allowed in this specification. If the allowance tolerances are exceeded, the Engineer shall reject the work and shall so advise the Contractor and the Deputy Chief Engineer (Structures), in writing, stating the deficiencies upon which the rejection is based. The Deputy Chief Engineer (Structures) shall review the nature and extent of the deficiencies and shall designate one of the following alternatives:

A. The affected concrete placement shall be removed and replaced in whole or part.

B. The Contractor shall provide special corrective measures as directed by the Deputy Chief Engineer (Structures).

C. The concrete placement shall be accepted without corrective action.

The concrete replacement or other corrective work which the Contractor is directed to perform shall be accomplished at no additional cost to the State.

D. Handling Galvanized Reinforcing Steel.

1.0 Responsibility of the Structure Contractor. The zinc coating on the reinforcing steel will withstand considerable abuse. However, the coating can be damaged when proper care is not exercised during shipping and construction handling. Therefore, the Contractor will be required to repair damage to the coatings as specified in paragraph 2B 9.0 of this specification. Visual inspection and repair of the coated steel at the construction site will be delayed until the steel is in place. This procedure will limit the task of inspection and repair to one operation and to that which is absolutely essential.

2.0 Responsibility of The Shipper. The coated bars will be bundled together for shipment by use of excelsior or equivalent padded metal bands. All personnel responsible for loading or unloading coated bars will use caution to avoid dragging or dropping the bundles.

4. METHOD OF MEASUREMENT:

Galvanized Reinforcing Steel shall be measured by the number of pounds of coated bars placed in accordance with the plans and specifications. The weight of bar reinforcement will be computed by the Engineer utilizing the unit weight for each size bar. The unit weight for computation shall be given in Subsection 709-01.

5. BASIS OF PAYMENT:

The unit price bid per pound of galvanized reinforcing steel shall include the furnishing of all labor, materials and equipment necessary to complete the work. The unit price shall also include the cost of furnishing and placing of chairs, supports, fastenings, and connections, as well as any splices not specifically shown on the plans. If the Engineer permits the substitution or larger bars than those specified, or permits splices not shown on the plans, or specifically ordered by him, payment will be made only for the amount of steel which would have been required, if the specified size and length of bar had been used.

APPENDIX B

SPECIFICATIONS FOR EPOXY COATED REINFORCEMENT BARS

		Page
1.	N.Y.S.D.O.T. Standard Specification: Section 709-04, Epoxy Coated Bar Reinforcement, Grade 60	87
2.	N.Y.S.D.O.T. Standard Specification: Section 602, Reinforcing Steel for Concrete Structures	91
3.	Test Method - N.Y. 329-76: Epoxy Coated Material for Steel Reinforcing Bars - Acceptance Requirements - for Epoxy Materials & Coating Applicators	97
4.	Approved List of Materials: Epoxy Coatings for Steel Reinforcing Bars	105

709-04 EPOXY COATED BAR REINFORCEMENT (GRADE 60)

SCOPE: This specification covers bar reinforcement with protective epoxy coatings that are applied by the electrostatic spray method or electrostatic fluidized bed method.

MATERIAL REQUIREMENTS:

1.0 Bar Reinforcement: Steel reinforcing bars shall conform to the requirements of Section 709-01, Bar Reinforcement, Grade 60.*

2.0 Epoxy Coating Material:

a. The epoxy coating material shall be an organic, powdered epoxy resin that is applied by electrostatic methods. Epoxy coating materials shall be approved by the Materials Bureau.

Detailed requirements and procedures for the acceptance of epoxy coating materials are available from the Materials Bureau. Upon approval of the product, the epoxy coating will be placed on a Department "Approved List" of materials.

b. The epoxy coating manufacturer shall supply written certification to the coating applicator, that the coating material is the same as that approved by the Materials Bureau.

3.0 Patching Material: Patching or repair materials shall be supplied by the epoxy coating manufacturer. The patching material shall be compatible with the epoxy coating; inert in concrete; and shall be suitable for use in making field repairs.

COATING APPLICATION:

1.0 Coating Applicator: The coating applicators facilities shall be approved by the Materials Bureau. Applications for approval of facilities shall be made to the Materials Bureau by the coating applicator. Upon approval, the name and address of the coating applicator will be placed on the Department's list of "Approved Applicators."

* This section specifies deformed bar reinforcement, meeting the requirements of ASTM A-615, Grade 60.

2.0 Surface Preparation:

a. The surface of bars to be coated shall be blast cleaned in accordance with the Steel Structures Painting Council - Surface Preparation Specification No. 10 (SSPC-SP10), Near White Blast Cleaning. After blasting, the cleaned surface of the bar shall be defined by SSPC-Vis 1, Pictorial Standards ASa 2½, BSa 2½, or CSa 2½, as applicable.

b. The powdered epoxy resin coating shall be applied to the cleaned surface as soon as possible after cleaning and before visible oxidation occurs. In no case shall more than 8 hours elapse between cleaning and coating.

3.0 Coating Application: The powdered epoxy resin coating shall be electrostatically applied in accordance with the recommendations of the coating manufacturer. The epoxy coating may be applied before or after fabrication of the reinforcing bars.

4.0 Coating Thickness: The epoxy coating shall be applied as a smooth, uniform coat. After curing, the coating thickness shall be 7 ± 2 mils. Coating thickness shall be controlled by taking measurements on a representative number of bars from each production lot. Coating thickness measurements shall be conducted by the method outlined in ASTM G-12.

5.0 Continuity of Coating:

a. The coating shall be checked visually after cure for continuity. It shall be free from holes, voids, contamination, cracks and damaged areas.

b. The coating shall not have more than two holidays (pinholes not visible to the naked ete) in any lineal foot of the coated bar. A holiday detector shall be used, in accordance with the manufacturer's instructions, to check the coating for holidays.

6.0 Coating Cure: The coating applicator shall check each production lot to determine that the entire production lot of coated bars is in a fully-cured condition.

7.0 Flexibility of Coating:

a. The flexibility of the coating shall be evaluated on a representative number of bars selected from each production lot. The coated bar shall be bent 120 degrees (after rebound)

around a 6-inch diameter mandrel. The bend shall be done at a uniform rate and may take up to one minute to complete. The test specimen shall be at thermal equilibrium between 20 and 30 degrees C (68-85^{O}F) at the time of testing.

b. No cracking of the coating shall be visible to the naked eye on the outside radius of the bent bar.

TESTING AND SAMPLING

1.0 Lot Size: For test purposes a production lot is the smallest number of reinforcing bars of the same type, heat and size as determined by the following requirements:

a. A lot shall not exceed a single order, or delivered load, whichever is smaller.

b. A lot shall consist of the number of bars as defined by the coating applicator except that it shall not exceed the number of reinforcing bars coated within a single working shift.

2.0 Quality Control: The coating applicator shall be responsible for performing quality control and tests. This will include inspection for compliance with the requirements of Coating Thickness, Continuity of Coating and Coating Cure and the testing required under Flexibility of Coating.

3.0 Plant Inspection:

a. The Department reserves the right to have its authorized representative observe the preparation, coating and testing of the reinforcement bars. The representative shall have free access to the plant and any work done when access has been denied shall be automatically rejected.

b. If the representative elects, lengths of coated bars may be taken from the production run, on a random basis, for test, evaluation and check purposes by the Materials Bureau.

SHOP REPAIR OF COATED BARS:

1.0 Epoxy coated reinforcement bars which do not meet the requirements for Coating Thickness, Continuity of Coating, Coating Cure or Flexibility of Coating shall not be repaired. Reinforcement bars with these defects shall be replaced or alternately, stripped of epoxy coating, recleaned and recoated in accordance with the requirements of this specification.

2.0 Coating breaks due to fabrication and handling shall be repaired with patching material, if the defective area is greater than the cross-sectional area of the reinforcement bar. Defects which are smaller than the cross-sectional area need not be repaired. The repair of coating breaks shall be limited to bars on which the total of the defective coating areas does not exceed 5 percent of the surface area of the reinforcement bar. Bars with greater than 5 percent damage shall be replaced or alternately, stripped of epoxy coating, recleaned and recoated in accordance with the requirements of this specification.

HANDLING: All systems for coated bars shall have padded contact areas for the bars, wherever possible. All bundling bands shall be padded and all bundles shall be lifted with a strong back, multiple supports or a platform bridge so as to prevent bar to bar abrasion from sags in the bar bundle. The bars or bundles shall not be dropped or dragged.

BASIS OF ACCEPTANCE: Epoxy coated reinforcement bars shall be accepted on the basis of the following:

1. All documentation required by Section 709-01, Bar Reinforcement, Grade 60.

2. The epoxy coating manufacturer's certification that the coating material is the same as that approved by the Materials Bureau.

3. The coating applicator's certification that the bars have been coated and tested and that they conform to the requirements of this specification.

All documentation shall be required for each shipment of epoxy coated reinforcement bars.

SECTION 602 REINFORCING STEEL FOR CONCRETE STRUCTURES

602-1 DESCRIPTION. The work will consist of furnishing and placing reinforcing steel for concrete structures, or stud shear connectors, in accordance with the Contract plans, and in a manner satisfactory to the Engineer.

Reinforcing steel for concrete structures may be either epoxy-coated, or plain (uncoated).

602-2 MATERIALS. Materials for this work shall meet the requirements of the following subsections of Subsection 700 MATERIALS.

Bar Reinforcement, Grade 60	709-01
Wire Fabric for Concrete Reinforcement	709-02
Epoxy-Coated Bar Reinforcement	709-04
Stud Shear Connectors	709-05

602-2.01 Epoxy-Coated Bar Reinforcement. Chairs, tie wires, and other devices used to support, position, or fasten the reinforcement shall be made of or coated with, a dielectric material. The specific hardware that the Contractor proposed to use shall be approved by the Engineer.

602-2.02 Plain Bar Reinforcement. Chairs, or other metal devices, shall be equipped with snug fitting, high density, polyethylene tips which provide one-quarter (1/4) inch minimum clearance between the metal and any exposed surface. Stainless steel tips may be used without polyethylene tips and shall meet the requirements of ASTM designation A276, Type 430.

602-3 CONSTRUCTION DETAILS

602-3.01 General.

A. Placing and Fastening Reinforcing Steel. Prior to placing reinforcing steel all grease, dirt, mortar and any other foreign substances shall be removed. Plain reinforcing steel shall also have all excessive mill scale and injurious rust removed.

For the purposes of this section, the term "injurious rust" shall be interpreted to mean rust which is not firmly bonded to the reinforcing steel Rust which is difficult to remove, even by vigorous scrubbing with a wire brush, shall be considered firmly bonded to the steel.

Steel reinforcement shall be placed in the position indicated and within the allowable tolerances specified. Before concrete is placed. all reinforcement shall be securely fastened and supported with approved chairs or other approved devices.

B. Inspection. Concrete shall not be placed until the reinforcing steel is inspected and permission for placing concrete is granted by the Engineer. All concrete placed in violation of this provision shall be rejected and removed.

602-3.02 Bar Reinforcement

A. Ordering. Prior to ordering reinforcing steel, the Contractor shall carefully check all bar lists, and assume full responsibility for their accuracy.

No change in the bar list shall be made by the Contractor unless approved by the D.C.E.S.

B. Field Bending.

1. Epoxy-Coated Bar Reinforcement. No field bending shall be permitted.

2. Plain Bar Reinforcement. When bars are heated for field bending they shall not be heated to a temperature higher than that producing a dark cherry red color. Only competent personnel shall be employed and proper equipment provided for cutting and bending.

   The reinforcement shall be bent to the shapes shown on the plans. Unless shown otherwise on the plans, the radii of bends measured to the inside face of the bend bar shall be equal to, or greater than, three times the diameter of the bar. Bends in stirrups shall be equal to, or greater than, the diameter of the bar.

C. Field Repair - Epoxy Coated Bars. The Contractor shall be required to field repair damaged areas of the bar coating, and to replace bars, exhibiting severly damaged coatings. The material used for field repair shall be that supplied by the coating applicator.

Field repair shall be required wherever the area of coating damage exceeds the cross-sectional area of the reinforcing bar.

Field repair shall not be allowed on bars which have severely damaged coatings. A severely damaged coating is defined as a coating which has a total damaged area greater than five (5) percent of the surface area of the reinforcing bar. The Engineer shall be the sole determiner of the severity of damaged areas for purposes of repair or replacement. A reinforcing bar having a coating determined by the Engineer to be severely damaged shall not be incorporated in the work and it shall be removed from the work site. All such bars shall be replaced in kind by the Contractor at no additional cost to the State.

D. Splices. Splices shall be permitted only where shown on the Contract plans. Should the Contractor desire to splice bars at locations other than those shown on the Contract plans, written permission to do so shall first be obtained from the D.C.E.S. Such permitted splices shall be well distributed, or located, at points of low tensile stress. Splices shall not be permitted unless a minimum of two (2) inches can be provided between the spliced bar and the nearest adjacent bar.

Splices for bars No. 11 or smaller, shall be made by placing the bars in contact and wiring them together for the full length of the splice.

Splices for bars larger than No. 11 shall be made by arc welding, or other types of positive connections. Arc welded splices shall be made in accordance with the New York State Steel Construction Manual requirements for welding (Subsection 203). Radiographic inspection will not be required. Other types of positive connections shall develop, in tension, at least ninety percent (90%) of the specified minimum tensile strength of the reinforcing bar. Proposed methods and details of positive connected splices shall be submitted to the D.C.E.S. for his approval.

Arc welding of epoxy-coated reinforcing bar splices shall require the end of the bar to be welded and to be entirely clean of epoxy coating for the full length of the splice plus six inches. After welding is complete, the cleaned portion of the bar shall be coated with epoxy. This may be accomplished by use of the epoxy patching material. Coating of the clean portion shall overlap the original epoxy coating by at least six inches.

E. Placement in Bridge Slabs. Bar supports shall be spaced no farther apart than 4'-0" center-to-center, nor shall any bar support be closer than 6" from the edge of any future concrete surface. Bridge slab bar reinforcement shall be placed in accordance with the following tolerances:

Vertical $\pm$ 1/4"
Horizontal $\pm$ 1/2"

The bridge slab bar reinforcement mats (top and bottom) shall be securely connected together. This connection may be accomplished by wiring or other means approved by the Engineer. Connections shall be placed no farther than four feet on centers. The bar supports may be utilized for this purpose. Connecting devices shall neither deflect the bar reinforcement nor interfere with the smooth flow of concrete.

Chairs, tie wires and other similar devices used for epoxy-coated bar reinforcement shall meet the requirements of subsection 602-2.01. Similar hardware used for plain bar reinforcement shall meet the requirements of subsection 602-2.01, or 602-2.02.

Immediately prior to placement of concrete, the Engineer shall verify that the reinforcing steel is positioned within the above-stated tolerances. If the allowable tolerances are exceeded, the Engineer shall order that the position of the reinforcing steel be corrected before he grants permission for placing concrete.

Subsequent to placement of concrete, the Engineer shall verify at random that the vertical clear distance from the top of the structural slab to the top mat of main reinforcing, as shown on the Contract Plans, is correct within a tolerance of plus or minus one-half (+1/2). If the allowable tolerance is exceeded, the Engineer shall reject the work and so advise the Contractor and the Deputy Chief Engineer (Structures), in writing, stating the deficiencies upon which the rejection is based. The Deputy Chief Engineer (Structures) shall review the nature and extent of the deficiencies and shall designate one or more of the following alternatives:

1. The affected concrete placement shall be removed and replaced in whole or in part.

2. The Contractor shall provide special corrective measures as directed by the Deputy Chief Engineer (Structures).

3. The concrete placement shall be accepted without corrective action.

The removal of the concrete placement and its subsequent replacement, or other corrective work which the Contractor is directed to perform, shall be accomplished at no additional cost to the State.

602-3.03 Stud Shear Connections for Bridges. The stud shear connectors shall be shop, or field welded to the structural steel at locations shown on the plans, as prescribed by subsection 208-STUD WELDING, of the New York State Steel Construction Manual.

602-4 METHOD OF MEASUREMENT

602-4.01 Steel Fabric Reinforcement. Steel Fabric Reinforcement shall be measured by number of square feet of fabric reinforcement placed.

602-4.02 Bar Reinforcement

A. Plain Reinforcing Bars. These shall be measured as the number of pounds of steel bars placed. The weight of bar reinforcing will be computed by the Engineer utilizing the unit weight for each size bar. Unit weights for computation shall be as given in Subsection 709-01.

B. Epoxy-Coated Reinforcing Bars. The requirements of subsection 602-4.02A shall apply. No allowance will be made for the weight of the epoxy coating.

602-4.03 Stud Shear Connectors for Bridges. Stud Shear Connectors shall be measured as each connector placed.

602-5 BASIS OF PAYMENT

602-5.01 Steel Fabric Reinforcement. The unit price bid per square foot shall include the cost of all labor, materials and equipment necessary to complete the work.

602-5.02 Bar Reinforcement. The unit price bid per pound shall include the cost of all labor, materials and equipment necessary to complete the work. The unit price shall also include the cost of chairs, supports, fastenings, connections, and any splices not specifically shown on the plans. If the Engineer permits the substitution of larger bars than those specified, or the D.C.E.S. permits splices not shown on the plans, payment will be made only for the amount of steel which would have been required if the specified size and length had been used.

602-5.03 Stud Shear Connectors for Bridges. The unit price bid per stud shall include the cost of all labor, materials and equipment necessary to complete the work. If the use of any stud shear connector requires payment of a royalty to the manufacturer, the royalty shall be included in the unit price bid for this work.

Payment will be made under.

ITEM NO.	ITEM	UNIT
602.0101	Steel Fabric Reinforcement for Structures	Square Foot
602.0201	Plain Bar Reinforcement for Concrete Structures	Pound
602.0202	Epoxy-coated Bar Reinforcement for Structures	Pound
602.03	Stud Shear Connectors for Bridges	Each

TEST METHOD N.Y. 329-76

EPOXY COATING MATERIAL FOR STEEL REINFORCING BARS

ACCEPTANCE REQUIREMENTS

REFERENCE: Materials Specification 709-04. Epoxy Coated Bar Reinforcement (Grade 60)

SCOPE: This test method covers the acceptance requirements for organic, powdered epoxy resin coating materials, that are electrostatically applied to steel reinforcement bars, to protect against corrosion.

GENERAL:

1. Epoxy coating materials shall be approved for use on the basis of the following:

   a) Epoxy resin powders which have been prequalified by the National Bureau of Standards for use as coatings on reinforcing steel are approved.

   b) Epoxy coatings which have not been prequalified by the NBS will be considered for approval on the basis of laboratory testing. Laboratory tests will be the responsibility of the coating manufacturer. The tests shall be performed by an independent laboratory which is acceptable to the Materials Bureau. The coating manufacturer should ensure the acceptance of the testing laboratory prior to conducting tests.

   Certified test results shall be submitted directly to the Materials Bureau, by the testing laboratory.

MATERIAL REQUIREMENTS:

1. The coating material shall be a powdered epoxy resin that is applied by electrostatic methods. The coating shall be of organic composition except for the pigment which may be inorganic if used.

2. A one pound sample of the coating material with its generic description (including percentages of pigments, diluents, fillers, flexibilizers and other additives) and its fingerprint (including the method such as infrared spectroscopy and thermal analysis) shall be submitted to both the testing agency and the Materials Bureau.

3. One quart of patching material, compatible with the coating and inert in concrete, shall be submitted to the testing agency. The material must be feasible for repairs to the coated reinforcing bars damaged by handling. The patching material may be a liquid which hardens to a solid on curing.

TEST SPECIMENS:

1. The following type and number of test specimens shall be submitted by the coating manufacturer for test: 12 No. 6 deformed reinforcing steel bars, grade 60, 4 feet in length and coated to the proposed thicknesses; 4 steel plates 4 x 4 x 0.050-inch and coated with a film thickness of 10 mils; and lastly, 3 films of epoxy(of the same thickness as that applied to the 12 bars) for the chloride permeability test.

2. Bars and plates shall be prepared and coated as follows:

   a) The surface of steel reinforcing bars shall be blast cleaned in accordance with SSPC-SP10, No. 10, Near-White Blast Cleaning. After blasting the cleaned surface of the bar shall be defined by SSPC-Vis 1, Pictorial Standards ASa 2½. BSa 2½, CSa 2½ or DSa 2½ as applicable.

   b) The surfaces of steel plates may be blast cleaned to a near-white condition or alternately, cleaned by the method and to the grade of preparation specified by the coating manufacturer.

   c) The powdered epoxy resin coating shall be electrostatically applied to the test specimen's (bars & plates) in accordance with the recommendations of the coating manufacturers. The coating shall be applied to the cleaned surface as soon as possible after cleaning and before visible oxidation occurs. In no case shall more than 8 hours elapse between cleaning and coating.

3. The coating and films shall be free from holes, voids, contamination, cracks, damaged areas, and holidays (pinholes not visible to the naked eye). The coatings shall be checked for holidays using a 67-1/2-volt detector, such as the Tinker and Rasor Model M-1 or its equivalent.

4. The reinforcing steel bars shall be uniformly coated over ridges and valleys with the deviation in coating thickness not exceeding $\pm$ 30 percent of $\pm$ 2 mils from the average thickness, whichever is less.

TEST REQUIREMENTS:

1. Chemical Resistance. The chemical resistance of coatings shall be evaluated according to ASTM G-20 by immersing coated reinforcing bars in each of the following: distilled water, an aqueous solution of 3M $CaCl_2$, an aqueous solution of 3M NaOH, and a solution saturated with $CA(OH)_2$. Specimens without holidays and specimens with intentional holes drilled through the coating 1/4-inch in diameter shall be tested. The temperature of the test solutions shall be 24 $\pm$ 2^{o}C. Minimum test time shall be 45 days. The coating must not blister, soften, loose bond, nor develop holidays during this period. The intentionally made holes shall exhibit no under cutting during the 45-day period.

2. Resistance to Applied Voltage - (Type of Accelerated Corrosion Test)

   a) The effects of electrical and electrochemical stresses on the bond of coatings to steel and on the film integrity of the coating shall be assessed. The methods given in Part A of ASTM G-8 shall be followed except:

      (1) The cathode and anode shall be reinforcing bars coated with the proposed material,

      (2) the electrolyte shall be an aqueous solution of 7 percent NaCl,

      (3) a potential of two volts shall be applied, and

      (4) no intentional holes shall be made.

      No film failures, as evidenced by evolution of hydrogen gas at the cathode or appearance of corrosion products of iron at the anode, shall take place during the first 1-hour of testing.

      The test shall be continued for 30 days and the elapsed time for development of the first holidays shall be recorded. If no holidays have developed after 30 days, then single intentional holes 1/4-inch in diameter shall be made in both the anode and cathode. Then the test shall be continued for an additional 24 hours in which time no undercutting shall occur.

3. Chloride Permeability. The chloride permeability characteristics of the films of cured coatings having the same thickness as proposed for use shall be measured by the methods

3. (continued)

   outlines in Report No. FHWA-RD-74-18. "Nonmetallic Coatings for Concrete Reinforcing Bars," by Clifton, Beeghly and Mathey, dated February 1974. The test shall be carried out at 24 $\pm$ 2°C for 45 days. The accumulative concentration of chloride ions permeating through the film shall be less than 1 x 10^{-4}M.

4. Flexibility of Coating.

   (a) The flexibility of coating shall be evaluated by bending the coated reinforcing bar 120 degrees (after rebound) around a 6-inch diameter wooden mandrel. The bend shall be made at a uniform rate and may take up to one minute to complete. The two longitudinal deformations may be placed in a plane perpendicular to the mandrel radius and the specimen shall be at thermal equilibrium of 24 $\pm$ 2°C.

   (b) No cracking of the coating shall be visible to the naked eye on the outside radius of the bent bar.

5. Bond Strength to Concrete.

   (a) The bond strength of coated reinforcing bars to concrete shall be determined with pull-out specimens by the methods given by Mathey and Watstein, ACI Journal, 32 (1961), pp. 1071-1090. The pull-out specimen should be a concrete prism 10 x 10 x 12-inches long with a No. 6 reinforcing bar embedded along the longitudinal axis of the specimen.

   (b) When in the opinion of the Materials Bureau the coating material contains appreciable quantities of pigments, diluents, fillers, flexibilizers, or other additives such that the creep of coated reinforcing steel embedded in Portland cement concrete might be critical, two specimens shall be tested under a 30,000 pounds per square inch load for a period of 45 days by the method described in Report No. FHWA-RD-74-18 by Clifton, Beeghly, and Mathey and titled, "Nonmetallic Coatings for Concrete Reinforcing Bars, Final Report." The creep specimens shall be a concrete prism 10 x 10 x 12-inches long with a No. 6 reinforcing bar embedded along the longitudinal axis of the specimen. The slip-ratio of coated bars to uncoated bars shall be no greater than 1.3 for free end slip or 1.6 for loaded end slip.

6. <u>Abrasion Resistance</u>. The resistance of a coating on each of the steel panels to abrasion by a Taber abraser or its equivalent, using CS-10 wheels and a 1000-gram load, shall be such that the weight loss shall not exceed 100 mg. per 1000 cycles.

7. <u>Impact Test</u>. The resistance of a reinforcing bar coating to mechanical damage shall be determined by the falling weight test. A test apparatus similar to that described in ASTM G-14 shall be used along with a 4 pound tup. Impact shall occur on the low-lying areas on the coated bars; i.e., between deformation ridges. The test shall be performed at room temperature. With an impact of 80 inch-pounds, no shattering, cracking, or bond loss of the coating shall occur except at the impact area; i.e., area permanently deformed by the tup.

8. <u>Hardness Test</u>. The hardness of coatings of steel reinforcing bars shall be determined by following the method of ASTM D-1474 using a 10g weight. The hardness shall exceed the Knoop Hardness number of 16.

<u>REPORT</u>: A report containing the certified results for all test requirements shall be submitted to the Materials Bureau by the testing agency.

EPOXY COATING APPLICATORS

REQUIREMENTS FOR APPROVED APPLICATORS.

Reference: Materials Specification 709-04, Epoxy Coated Bar Reinforcement (Grade 60)

Scope: The intent of this document is to describe the criteria by which coating application facilities will be judged for approval by the Materials Bureau.

Requirements:

1.0 Coating Plant: The coating applicator's facilities for cleaning and coating reinforcement bars are to be contained in a single permanent structure. Work performed in temporary structures or open yards will not be allowed.

2.0 Production Rate: The coating applicators facilities shall be capable of cleaning and coating a minimum of 5000 lineal feet of reinforcing bar within any 8 hour work shift.

3.0 Quality Control: The coating applicator will show evidence and demonstrate his quality control. Equipment necessary to check conformance to § 709-04 Epoxy Coated Bar Reinforcement (Grade 60), shall be available.

4.0 Lighting: The coating applicators facilities shall be adequately lit. Particular attention will be paid to lighting facilities where bars are cleaned and where coated bars are repaired.

5.0 Cleaning Equipment: Only automated cleaning equipment will be considered acceptable. This will include wheel and centrifugal blasting equipment. Hand blasting methods are not acceptable.

6.0 Coating Application Equipment: The coating applicator shall be equipped to electrastatically apply the epoxy resin coating in the manner specified by the coating manufacturer. If the bars are pre-heated, controls shall be established to monitor pre-heat temperature.

7.0 Holiday Detectors: The coating applicator shall have in-line holiday detectors for straight bar production. The detectors shall be equipped with automatic marking capability. The detection of holidays by hand held detectors is not acceptable for straight bars.

8.0 Repair and Touch-up: The coating facility shall have sufficient area and personnel, to touch-up coated bars, immediately after the general application of epoxy coating.

9.0 Handling & Shipping: The coating applicator shall have suitable materials and equipment so as to bundle and ship the coated bars with minimal damage.

Report: The report shall state whether or not the plant is in compliance with all the above requirements.

APPROVED LIST OF MATERIALS

EPOXY COATINGS FOR STEEL REINFORCING BARS

1. SCOPE: The following lists represent products, manufacturers or suppliers approved by the Materials Bureau. Approved products are accepted on the basis of the brand name labeled on the container. The products specified on the manufacturers or suppliers lists are accepted on the basis of the material coming from a manufacturer or supplier appearing on the list. A new listing will be published in the Spring of 1977.

7.42-2-27 EPOXY COATINGS FOR STEEL REINFORCING BARS

COATING

BRAND NAME	MANUFACTURER/SUPPLIER
Corvel ECA-1588, Red-27000	The Polymer Corp. Reading, PA
Epoxy Powder 720-A-009	Cook Paint & Varnish Co. North Kansas City, MO
Flintflex 531-6020 or 531-6080	E. I. DuPont de Nemours, Inc. Wilmington, DE
Scotchkote 202	Minnesota Mining & Manufacturing Co. St. Paul, MN

APPLICATORS

APPLICATOR	LOCATION
H. C. Price Co. Pipe Coating Division	Fairless Hills, PA
M. C. P. Facilities Corp.	Bath, PA

APPENDIX C

PACHOMETER AND CORROSION POTENTIAL DATA

Contents

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1. Pachometer Measurements - Arcade Test Site	110
2. 1975 Corrosion Potential Measurements - Arcade Test Site	120
3. 1976 Corrosion Potential Measurements - Arcade Test Site	130

KEY TO DATA POINT LOCATIONS
(ARCADE TEST SITE)

1. ROWS - represent Transverse Reference grid locations.

	ROW NUMBER (Spans 1, 2, 3 & 4)										
	57	53	49	45	41	37	33	29	25	21	18
Transverse Reference (Ft.)	2'	7'	12'	17'	22'	27'	32'	37'	42'	47'	51'

2. COLUMNS - represent Longitudinal Reference grid locations.

SPAN 1	
Column No.	Long. Reference
37	1'
42	6'
47	11'
52	16'
57	21'
62	26'
67	31'
72	36'
77	41'
82	46'
87	51'
92	56'

SPAN 2 & 3	
Column No.	Long. Reference
18	5'
23	10'
28	15'
32	20'
37	25'
42	30'
47	35'
52	40'
57	45'
62	50'
68	55'
73	60'
78	65'
83	70'
88	75'
93	80'
98	85'
103	90'
108	95'
113	100'

SPAN 4	
Column No.	Long. Reference
28	5'
33	10'
38	15'
43	20'
48	25'
53	30'
58	35'
63	40'
68	45'
73	50'
78	55'
83	60'
88	65'
93	70'
98	75'

MAP 1

COUNTY LINE-ARCADE FARC 74-182 PIN 4008.00.321
SPAN NO. 1 PACHOMETER READINGS 9/30/75

MAP SCALE = 0.1000 INCHES ON OUTPUT MAP/UNITS ON SOURCE MAP

MAP SHOULD BE PRINTED AT 8.0 ROWS PER INCH AND 10.0 COLUMNS PER INCH

ROW = (DOWN COORDINATE - -73.50) * 0.8000
COLUMN = (ACROSS COORDINATE - -36.00) * 1.0000

DATA POINTS FOR MAP

POINT	ROW	COLUMN	DATUM	VALUE	LEVEL
1)	57	37	1	2.25	3
2)	57	42	2	2.25	3
3)	53	42	3	2.25	3
4)	49	42	4	2.25	3
5)	57	47	5	2.25	3
6)	53	47	6	2.50	3
7)	49	47	7	2.25	3
8)	45	47	8	2.25	3
9)	41	47	9	3.00	4
10)	57	52	10	2.50	3
11)	53	52	11	2.50	3
12)	49	52	12	2.50	3
13)	45	52	13	2.75	3
14)	41	52	14	2.25	3
15)	37	52	15	2.25	3
16)	33	52	16	2.50	3
17)	57	57	17	2.50	3
18)	53	57	18	2.50	3
19)	49	57	19	2.25	3
20)	45	57	20	3.00	4
21)	41	57	21	3.00	4
22)	37	57	22	2.50	3
23)	33	57	23	3.00	4
24)	29	57	24	3.00	4
25)	25	57	25	2.50	3
26)	21	57	26	3.00	4
27)	57	62	27	2.50	3
28)	53	62	28	2.50	3
29)	49	62	29	2.50	3
30)	45	62	30	2.50	3
31)	41	62	31	3.00	4
32)	37	62	32	2.25	3
33)	33	62	33	3.00	4
34)	29	62	34	2.75	3
35)	25	62	35	3.00	4
36)	21	62	36	3.00	4
37)	18	62	37	2.75	3
38)	57	67	38	2.50	3
39)	53	67	39	2.50	3
40)	49	67	40	2.50	3
41)	45	67	41	2.75	3
42)	41	67	42	2.75	3
43)	37	67	43	2.50	3
44)	33	67	44	2.50	3
45)	29	67	45	3.00	4
46)	25	67	46	3.00	4
47)	21	67	47	3.00	4
48)	18	67	48	3.00	4
49)	57	72	49	2.25	3
50)	53	72	50	2.50	3
51)	49	72	51	2.25	3
52)	45	72	52	3.00	4
53)	41	72	53	3.00	4

54)	37	72	54	2.50	3
55)	33	72	55	2.50	3
56)	29	72	56	2.25	3
57)	25	72	57	2.75	3
58)	21	72	58	3.00	4
59)	18	72	59	2.75	3
60)	53	77	60	2.75	3
61)	49	77	61	2.25	3
62)	45	77	62	3.00	4
63)	41	77	63	2.75	3
64)	37	77	64	2.50	3
65)	33	77	65	2.50	3
66)	29	77	66	2.75	3
67)	25	77	67	2.75	3
68)	21	77	68	2.75	3
69)	18	77	69	2.50	3
70)	41	82	70	2.75	3
71)	37	82	71	2.25	3
72)	33	82	72	3.00	4
73)	29	82	73	2.75	3
74)	25	82	74	2.50	3
75)	21	82	75	2.75	3
76)	18	82	76	2.75	3
77)	29	87	77	2.50	3
78)	25	87	78	2.50	3
79)	21	87	79	3.00	4
80)	18	87	80	2.75	3
81)	18	92	81	2.75	3

STANDARD SEARCH RADIUS IS 9.4407

MAP 1

COUNTY LINE-ARCADE FARC 74-182 PIN 4008,00.321
SPAN NO. 2- PACHOMETER READINGS 9/30/75

MAP SCALE = 0.1000 INCHES ON OUTPUT MAP/UNITS ON SOURCE MAP

MAP SHOULD BE PRINTED AT 8.0 ROWS PER INCH AND 10.0 COLUMNS PER INCH

ROW = (DOWN COORDINATE - -73.50) * 0.8000
COLUMN = (ACROSS COORDINATE - -12.50) * 1.0000

DATA POINTS FOR MAP

POINT	ROW	COLUMN	DATUM	VALUE	LEVEL
1)	57	18	1	2.50	3
2)	53	18	2	2.25	3
3)	49	18	3	2.00	3
4)	57	23	4	2.50	3
5)	53	23	5	2.50	3
6)	49	23	6	2.25	3
7)	45	23	7	2.00	3
8)	41	23	8	2.25	3
9)	57	28	9	2.50	3
10)	53	28	10	2.25	3
11)	49	28	11	2.25	3
12)	45	28	12	2.25	3
13)	41	28	13	2.25	3
14)	37	28	14	2.25	3
15)	33	28	15	2.75	3
16)	29	28	16	2.25	3
17)	25	28	17	2.50	3
18)	57	32	18	2.50	3
19)	53	32	19	2.25	3
20)	49	32	20	2.00	3
21)	45	32	21	2.50	3
22)	41	32	22	2.25	3
23)	37	32	23	2.50	3
24)	33	32	24	2.75	3
25)	29	32	25	2.50	3
26)	25	32	26	2.50	3
27)	21	32	27	2.75	3
28)	18	32	28	2.75	3
29)	57	37	29	2.00	3
30)	53	37	30	2.00	3
31)	49	37	31	2.25	3
32)	45	37	32	2.00	3
33)	41	37	33	2.00	3
34)	37	37	34	2.50	3
35)	33	37	35	3.00	4
36)	29	37	36	2.75	3
37)	25	37	37	2.50	3
38)	21	37	38	2.50	3
39)	57	42	39	1.75	2
40)	53	42	40	1.50	2
41)	49	42	41	1.50	2
42)	45	42	42	1.75	2
43)	41	42	43	2.00	3
44)	37	42	44	2.50	3
45)	33	42	45	2.75	3
46)	29	42	46	2.75	3
47)	25	42	47	2.25	3
48)	21	42	48	2.75	3
49)	57	47	49	2.25	3
50)	53	47	50	2.00	3
51)	49	47	51	2.00	3
52)	45	47	52	2.00	3
53)	41	47	53	1.75	2
54)	37	47	54	2.00	3

55)	33	47	55	2.25	3
56)	29	47	56	2.25	3
57)	25	47	57	2.50	3
58)	21	47	58	3.00	4
59)	57	52	59	2.00	3
60)	53	52	60	1.50	2
61)	49	52	61	2.25	3
62)	45	52	62	2.00	3
63)	41	52	63	1.50	2
64)	37	52	64	1.75	2
65)	33	52	65	2.25	3
66)	29	52	66	1.75	2
67)	25	52	67	2.25	3
68)	21	52	68	3.00	4
69)	57	57	69	2.00	3
70)	53	57	70	1.75	2
71)	49	57	71	1.75	2
72)	45	57	72	1.75	2
73)	41	57	73	1.75	2
74)	37	57	74	1.50	2
75)	33	57	75	2.00	3
76)	29	57	76	2.00	3
77)	25	57	77	2.25	3
78)	21	57	78	2.25	3
79)	57	62	79	2.00	3
80)	53	62	80	2.00	3
81)	49	62	81	2.00	3
82)	45	62	82	1.75	2
83)	41	62	83	1.75	2
84)	37	62	84	1.50	2
85)	33	62	85	2.50	3
86)	29	62	86	2.50	3
87)	25	62	87	2.50	3
88)	21	62	88	2.50	3
89)	57	68	89	2.00	3
90)	53	68	90	1.75	2
91)	49	68	91	1.50	2
92)	45	68	92	1.50	2
93)	41	68	93	1.75	2
94)	37	68	94	2.00	3
95)	33	68	95	2.25	3
96)	29	68	96	2.25	3
97)	25	68	97	1.75	2
98)	21	68	98	2.50	3
99)	57	73	99	2.00	3
100)	53	73	100	2.00	3
101)	49	73	101	1.50	2
102)	45	73	102	2.00	3
103)	41	73	103	1.75	2
104)	37	73	104	1.75	2
105)	33	73	105	2.00	3
106)	29	73	106	2.25	3
107)	25	73	107	2.25	3
108)	21	73	108	2.50	3
109)	18	73	109	2.25	3
110)	57	78	110	2.25	3
111)	53	78	111	1.75	2
112)	49	78	112	1.75	2
113)	45	78	113	1.75	2
114)	41	78	114	1.50	2
115)	37	78	115	1.50	2
116)	33	78	116	1.75	2
117)	29	78	117	2.25	3
118)	25	78	118	2.25	3
119)	21	78	119	2.75	3
120)	18	78	120	2.50	3
121)	57	83	121	1.75	2
122)	53	83	122	2.25	3
123)	49	83	123	2.25	3
124)	45	83	124	2.25	3
125)	41	83	125	2.00	3
126)	37	83	126	2.00	3
127)	33	83	127	2.75	3
128)	29	83	128	2.25	3
129)	25	83	129	2.75	3
130)	21	83	130	3.00	4
131)	18	83	131	2.50	3
132)	57	88	132	2.25	3
133)	53	88	133	2.25	3
134)	49	88	134	2.25	3
135)	45	88	135	2.00	3
136)	41	88	136	1.50	2

137)	37	88	137	2.00	3
138)	33	88	138	2.25	3
139)	29	88	139	2.25	3
140)	25	88	140	2.50	3
141)	21	88	141	2.75	3
142)	18	88	142	2.75	3
143)	53	93	143	2.25	3
144)	49	93	144	2.25	3
145)	45	93	145	2.25	3
146)	41	93	146	2.00	3
147)	37	93	147	2.50	3
148)	33	93	148	2.75	3
149)	29	93	149	2.25	3
150)	25	93	150	2.25	3
151)	21	93	151	2.50	3
152)	18	93	152	2.50	3
153)	45	98	153	2.75	3
154)	41	98	154	2.25	3
155)	37	98	155	2.00	3
156)	33	98	156	2.50	3
157)	29	98	157	2.75	3
158)	25	98	158	2.00	3
159)	21	98	159	2.50	3
160)	18	98	160	2.75	3
161)	37	103	161	2.50	3
162)	33	103	162	2.50	3
163)	29	103	163	2.50	3
164)	25	103	164	2.25	3
165)	21	103	165	3.00	4
166)	18	103	166	3.00	4
167)	29	108	167	2.25	3
168)	25	108	168	2.50	3
169)	21	108	169	2.50	3
170)	18	108	170	3.00	4
171)	21	113	171	3.00	4
172)	18	113	172	2.50	3

STANDARD SEARCH RADIUS IS 8.3999

MAP 1

COUNTY LINE-ARCADE FARC 74-182 PIN 4008.00.321
SPAN NO. 3- PACHOMETER READINGS 10/1/75

MAP SCALE = 0.1000 INCHES ON OUTPUT MAP/UNITS ON SOURCE MAP

MAP SHOULD BE PRINTED AT 8.0 ROWS PER INCH AND 10.0 COLUMNS PER INCH

ROW = (DOWN COORDINATE - -73.50) * 0.8000
COLUMN = (ACROSS COORDINATE - -12.50) * 1.0000

DATA POINTS FOR MAP

POINT	ROW	COLUMN	DATUM	VALUE	LEVEL
1)	57	18	1	2.00	3
2)	53	18	2	1.50	2
3)	57	23	3	1.75	2
4)	53	23	4	1.50	2
5)	49	23	5	1.75	2
6)	45	23	6	2.25	3
7)	41	23	7	2.25	3
8)	57	28	8	1.50	2
9)	53	28	9	1.25	2
10)	49	28	10	1.75	2
11)	45	28	11	2.00	3
12)	41	28	12	2.00	3
13)	37	28	13	2.25	3
14)	33	28	14	2.25	3
15)	57	32	15	1.50	2
16)	53	32	16	1.25	2
17)	49	32	17	1.75	2
18)	45	32	18	2.00	3
19)	41	32	19	1.75	2
20)	37	32	20	2.00	3
21)	33	32	21	2.50	3
22)	29	32	22	2.25	3
23)	25	32	23	2.50	3
24)	21	32	24	2.25	3
25)	57	37	25	1.75	2
26)	53	37	26	1.50	2
27)	49	37	27	1.75	2
28)	45	37	28	2.00	3
29)	41	37	29	1.75	2
30)	37	37	30	2.00	3
31)	33	37	31	2.25	3
32)	29	37	32	2.25	3
33)	25	37	33	2.50	3
34)	21	37	34	2.50	3
35)	18	37	35	2.25	3
36)	57	42	36	2.00	3
37)	53	42	37	1.75	2
38)	49	42	38	1.75	2
39)	45	42	39	2.00	3
40)	41	42	40	1.75	2
41)	37	42	41	2.00	3
42)	33	42	42	2.25	3
43)	29	42	43	2.25	3
44)	25	42	44	2.50	3
45)	21	42	45	2.50	3
46)	18	42	46	2.25	3
47)	57	47	47	2.00	3
48)	53	47	48	1.50	2
49)	49	47	49	2.00	3
50)	45	47	50	2.00	3
51)	41	47	51	2.00	3
52)	37	47	52	2.00	3
53)	33	47	53	2.50	3

54)	29	47	54	2.25	3
55)	25	47	55	2.25	3
56)	21	47	56	2.50	3
57)	18	47	57	2.50	3
58)	57	52	58	1.75	2
59)	53	52	59	1.25	2
60)	49	52	60	2.00	3
61)	45	52	61	1.75	2
62)	41	52	62	2.00	3
63)	37	52	63	2.50	3
64)	33	52	64	2.50	3
65)	29	52	65	2.25	3
66)	25	52	66	2.50	3
67)	21	52	67	3.00	4
68)	18	52	68	2.50	3
69)	57	57	69	2.00	3
70)	53	57	70	1.50	2
71)	49	57	71	1.75	2
72)	45	57	72	2.00	3
73)	41	57	73	2.00	3
74)	37	57	74	2.25	3
75)	33	57	75	2.50	3
76)	29	57	76	2.50	3
77)	25	57	77	2.50	3
78)	21	57	78	2.75	3
79)	18	57	79	2.25	3
80)	57	62	80	1.75	2
81)	53	62	81	2.25	3
82)	49	62	82	2.00	3
83)	45	62	83	2.25	3
84)	41	62	84	2.00	3
85)	37	62	85	2.00	3
86)	33	62	86	2.00	3
87)	29	62	87	2.25	3
88)	25	62	88	2.50	3
89)	21	62	89	2.50	3
90)	18	62	90	2.50	3
91)	57	68	91	2.00	3
92)	53	68	92	2.00	3
93)	49	68	93	1.75	2
94)	45	68	94	2.00	3
95)	41	68	95	2.00	3
96)	37	68	96	2.25	3
97)	33	68	97	2.25	3
98)	29	68	98	2.50	3
99)	25	68	99	2.50	3
100)	21	68	100	2.50	3
101)	18	68	101	2.50	3
102)	57	73	102	1.75	2
103)	53	73	103	1.75	2
104)	49	73	104	2.25	3
105)	45	73	105	2.00	3
106)	41	73	106	2.00	3
107)	37	73	107	2.00	3
108)	33	73	108	2.25	3
109)	29	73	109	2.50	3
110)	25	73	110	2.25	3
111)	21	73	111	2.75	3
112)	18	73	112	2.25	3
113)	57	78	113	2.00	3
114)	53	78	114	1.75	2
115)	49	78	115	2.00	3
116)	45	78	116	2.00	3
117)	41	78	117	2.00	3
118)	37	78	118	2.25	3
119)	33	78	119	2.50	3
120)	29	78	120	2.50	3
121)	25	78	121	2.50	3
122)	21	78	122	3.00	4
123)	57	83	123	2.00	3
124)	53	83	124	2.00	3
125)	49	83	125	2.25	3
126)	45	83	126	2.00	3
127)	41	83	127	2.00	3
128)	37	83	128	2.25	3
129)	33	83	129	2.25	3
130)	29	83	130	2.25	3
131)	25	83	131	2.50	3
132)	21	83	132	3.00	4
133)	57	88	133	2.00	3
134)	53	88	134	1.75	2
135)	49	88	135	2.25	3

136)	45	88	136	2.00	3
137)	41	88	137	2.00	3
138)	37	88	138	2.00	3
139)	33	88	139	2.25	3
140)	29	88	140	2.25	3
141)	25	88	141	2.50	3
142)	21	88	142	3.00	4
143)	57	93	143	2.25	3
144)	53	93	144	1.75	2
145)	49	93	145	2.00	3
146)	45	93	146	2.25	3
147)	41	93	147	2.00	3
148)	37	93	148	2.25	3
149)	33	93	149	2.25	3
150)	29	93	150	2.25	3
151)	25	93	151	2.50	3
152)	21	93	152	3.00	4
153)	49	98	153	2.75	3
154)	45	98	154	2.00	3
155)	41	98	155	2.00	3
156)	37	98	156	2.25	3
157)	33	98	157	2.25	3
158)	29	98	158	2.25	3
159)	25	98	159	2.50	3
160)	21	98	160	3.00	4
161)	37	103	161	1.75	2
162)	33	103	162	2.25	3
163)	29	103	163	2.25	3
164)	25	103	164	2.25	3
165)	21	103	165	2.75	3
166)	29	108	166	2.00	3
167)	25	108	167	2.50	3
168)	21	108	168	2.75	3
169)	21	113	169	2.75	3

STANDARD SEARCH RADIUS IS 8.4759

MAP 1

COUNTY LINE-ARCADE FARC 74-182 PIN 4008.00.321
SPAN NO. 4- PACHOMETER READINGS 10/2/75

MAP SCALE = 0.1000 INCHES ON OUTPUT MAP/UNITS ON SOURCE MAP

MAP SHOULD BE PRINTED AT 8.0 ROWS PER INCH AND 10.0 COLUMNS PER INCH

ROW = (DOWN COORDINATE - -73.50) * 0.8000
COLUMN = (ACROSS COORDINATE - -24.50) * 1.0000

DATA POINTS FOR MAP

POINT	ROW	COLUMN	DATUM	VALUE	LEVEL
1)	57	30	1	1.75	2
2)	53	30	2	1.75	2
3)	49	30	3	3.00	4
4)	57	34	4	1.75	2
5)	53	34	5	1.75	2
6)	49	34	6	2.00	3
7)	45	34	7	2.50	3
8)	41	34	8	2.25	3
9)	57	39	9	2.00	3
10)	53	39	10	1.75	2
11)	49	39	11	2.00	3
12)	45	39	12	2.25	3
13)	41	39	13	2.00	3
14)	37	39	14	2.25	3
15)	33	39	15	2.25	3
16)	57	44	16	2.25	3
17)	53	44	17	2.25	3
18)	49	44	18	2.25	3
19)	45	44	19	2.25	3
20)	41	44	20	2.00	3
21)	37	44	21	1.75	2
22)	33	44	22	2.25	3
23)	29	44	23	2.00	3
24)	25	44	24	2.25	3
25)	57	49	25	2.25	3
26)	53	49	26	2.00	3
27)	49	49	27	2.00	3
28)	45	49	28	2.50	3
29)	41	49	29	1.75	2
30)	37	49	30	2.00	3
31)	33	49	31	2.25	3
32)	29	49	32	2.00	3
33)	25	49	33	2.25	3
34)	21	49	34	2.50	3
35)	18	49	35	2.50	3
36)	57	54	36	2.25	3
37)	53	54	37	2.25	3
38)	49	54	38	2.50	3
39)	45	54	39	2.25	3
40)	41	54	40	2.00	3
41)	37	54	41	2.25	3
42)	33	54	42	2.25	3
43)	29	54	43	2.00	3
44)	25	54	44	2.25	3
45)	21	54	45	2.50	3
46)	18	54	46	2.50	3
47)	57	59	47	2.25	3
48)	53	59	48	2.25	3
49)	49	59	49	2.50	3
50)	45	59	50	2.25	3
51)	41	59	51	2.00	3
52)	37	59	52	2.25	3
53)	33	59	53	2.50	3
54)	29	59	54	2.25	3

55)	25	59	55	2.25	3
56)	21	59	56	2.50	3
57)	18	59	57	2.25	3
58)	57	65	58	2.50	3
59)	53	65	59	2.25	3
60)	49	65	60	2.25	3
61)	45	65	61	2.25	3
62)	41	65	62	2.25	3
63)	37	65	63	2.50	3
64)	33	65	64	2.25	3
65)	29	65	65	2.25	3
66)	25	65	66	2.25	3
67)	21	65	67	2.50	3
68)	18	65	68	2.25	3
69)	57	70	69	2.25	3
70)	53	70	70	2.25	3
71)	49	70	71	3.00	4
72)	45	70	72	2.25	3
73)	41	70	73	2.00	3
74)	37	70	74	2.25	3
75)	33	70	75	2.50	3
76)	29	70	76	2.25	3
77)	25	70	77	2.50	3
78)	21	70	78	2.50	3
79)	18	70	79	2.50	3
80)	57	75	80	2.25	3
81)	53	75	81	2.25	3
82)	49	75	82	2.50	3
83)	45	75	83	2.50	3
84)	41	75	84	2.00	3
85)	37	75	85	2.25	3
86)	33	75	86	2.25	3
87)	29	75	87	2.25	3
88)	25	75	88	2.50	3
89)	21	75	89	2.50	3
90)	18	75	90	2.25	3
91)	57	80	91	2.50	3
92)	53	80	92	2.25	3
93)	49	80	93	2.25	3
94)	45	80	94	2.50	3
95)	41	80	95	2.00	3
96)	37	80	96	2.25	3
97)	33	80	97	2.50	3
98)	29	80	98	2.25	3
99)	25	80	99	2.50	3
100)	21	80	100	2.50	3
101)	18	80	101	2.25	3
102)	49	85	102	2.25	3
103)	45	85	103	2.50	3
104)	41	85	104	2.50	3
105)	37	85	105	2.25	3
106)	33	85	106	2.50	3
107)	29	85	107	2.50	3
108)	25	85	108	2.25	3
109)	21	85	109	2.50	3
110)	18	85	110	2.25	3
111)	41	90	111	3.00	4
112)	37	90	112	2.00	3
113)	33	90	113	2.50	3
114)	29	90	114	2.50	3
115)	25	90	115	2.25	3
116)	21	90	116	2.50	3
117)	18	90	117	2.75	3
118)	33	95	118	3.00	4
119)	29	95	119	2.25	3
120)	25	95	120	2.25	3
121)	21	95	121	2.75	3
122)	18	95	122	2.50	3
123)	25	100	123	3.00	4
124)	21	100	124	2.50	3
125)	18	100	125	2.50	3

STANDARD SEARCH RADIUS IS 8.4962

MAP 1

COUNTY LINE-ARCADE (ARC 74-182 PIN 4008.00.321
SPAN NO. 1 - CORROSION POTENTIAL READINGS 9/30/75

MAP SCALE = 0.1000 INCHES ON OUTPUT MAP/UNITS ON SOURCE MAP

MAP SHOULD BE PRINTED AT 8.0 ROWS PER INCH AND 10.0 COLUMNS PER INCH

ROW = (DOWN COORDINATE - -73.50) * 0.8000
COLUMN = (ACROSS COORDINATE - -36.00) * 1.0000

DATA POINTS FOR MAP

POINT	ROW	COLUMN	DATUM	VALUE	LEVEL
1)	57	37	1	0.26	2
2)	57	42	2	0.27	2
3)	53	42	3	0.30	2
4)	49	42	4	0.22	2
5)	57	47	5	0.31	2
6)	53	47	6	0.28	2
7)	49	47	7	0.24	2
8)	45	47	8	0.32	2
9)	41	47	9	0.26	2
10)	57	52	10	0.32	2
11)	53	52	11	0.27	2
12)	49	52	12	0.23	2
13)	45	52	13	0.31	2
14)	41	52	14	0.20	2
15)	37	52	15	0.37	3
16)	33	52	16	0.31	2
17)	57	57	17	0.31	2
18)	53	57	18	0.28	2
19)	49	57	19	0.22	2
20)	45	57	20	0.31	2
21)	41	57	21	0.26	2
22)	37	57	22	0.36	3
23)	33	57	23	0.28	2
24)	29	57	24	0.33	2
25)	25	57	25	0.30	2
26)	21	57	26	0.28	2
27)	57	62	27	0.31	2
28)	53	62	28	0.35	2
29)	49	62	29	0.30	2
30)	45	62	30	0.33	2
31)	41	62	31	0.23	2
32)	37	62	32	0.35	2
33)	33	62	33	0.28	2
34)	29	62	34	0.34	2
35)	25	62	35	0.38	3
36)	21	62	36	0.31	2
37)	18	62	37	0.39	3
38)	57	67	38	0.29	2
39)	53	67	39	0.34	2
40)	49	67	40	0.29	2
41)	45	67	41	0.34	2
42)	41	67	42	0.24	2
43)	37	67	43	0.33	2
44)	33	67	44	0.29	2
45)	29	67	45	0.31	2
46)	25	67	46	0.33	2
47)	21	67	47	0.31	2
48)	18	67	48	0.36	3
49)	57	72	49	0.28	2
50)	53	72	50	0.33	2
51)	49	72	51	0.28	2
52)	45	72	52	0.34	2
53)	41	72	53	0.21	2
54)	37	72	54	0.33	2

55)	33	72	55	0.33	2
56)	29	72	56	0.32	2
57)	25	72	57	0.31	2
58)	21	72	58	0.29	2
59)	18	72	59	0.36	3
60)	53	77	60	0.22	2
61)	49	77	61	0.21	2
62)	45	77	62	0.32	2
63)	41	77	63	0.20	2
64)	37	77	64	0.36	3
65)	33	77	65	0.27	2
66)	29	77	66	0.32	2
67)	25	77	67	0.34	2
68)	21	77	68	0.30	2
69)	18	77	69	0.34	2
70)	41	82	70	0.17	1
71)	37	82	71	0.25	2
72)	33	82	72	0.29	2
73)	29	82	73	0.32	2
74)	25	82	74	0.33	2
75)	21	82	75	0.29	2
76)	18	82	76	0.32	2
77)	29	87	77	0.21	2
78)	25	87	78	0.28	2
79)	21	87	79	0.26	2
80)	18	87	80	0.31	2
81)	18	92	81	0.28	2

STANDARD SEARCH RADIUS IS 9.4407

MAP 1

COUNTY LINE-ARCADE FARC 74-182 PIN 4008.00.321
SPAN NO. 2 - CORROSION POTENTIAL READINGS 9/30/75

MAP SCALE = 0.1000 INCHES ON OUTPUT MAP/UNITS ON SOURCE MAP

MAP SHOULD BE PRINTED AT 8.0 ROWS PER INCH AND 10.0 COLUMNS PER INCH

ROW = (DOWN COORDINATE - -73.50) * 0.6000
COLUMN = (ACROSS COORDINATE - -12.50) * 1.0000

DATA POINTS FOR MAP

POINT	ROW	COLUMN	DATUM	VALUE	LEVEL
1)	57	18	1	0.31	2
2)	53	18	2	0.30	2
3)	49	18	3	0.24	2
4)	57	23	4	0.33	2
5)	53	23	5	0.30	2
6)	49	23	6	0.22	2
7)	45	23	7	0.31	2
8)	41	23	8	0.22	2
9)	57	28	9	0.23	2
10)	53	28	10	0.33	2
11)	49	28	11	0.27	2
12)	45	28	12	0.26	2
13)	41	28	13	0.26	2
14)	37	28	14	0.31	2
15)	33	28	15	0.22	2
16)	29	28	16	0.26	2
17)	25	28	17	0.18	1
18)	57	32	18	0.27	2
19)	53	32	19	0.27	2
20)	49	32	20	0.21	2
21)	45	32	21	0.28	2
22)	41	32	22	0.17	1
23)	37	32	23	0.22	2
24)	33	32	24	0.20	2
25)	29	32	25	0.16	1
26)	25	32	26	0.22	2
27)	21	32	27	0.16	1
28)	57	37	28	0.26	2
29)	53	37	29	0.26	2
30)	49	37	30	0.25	2
31)	45	37	31	0.29	2
32)	41	37	32	0.14	1
33)	37	37	33	0.17	1
34)	33	37	34	0.19	1
35)	29	37	35	0.18	1
36)	25	37	36	0.28	2
37)	21	37	37	0.22	2
38)	57	42	38	0.31	2
39)	53	42	39	0.38	3
40)	49	42	40	0.31	2
41)	45	42	41	0.40	3
42)	41	42	42	0.25	2
43)	37	42	43	0.29	2
44)	33	42	44	0.22	2
45)	29	42	45	0.27	2
46)	25	42	46	0.22	2
47)	21	42	47	0.24	2
48)	57	47	48	0.36	3
49)	53	47	49	0.40	3
50)	49	47	50	0.35	2
51)	45	47	51	0.45	3
52)	41	47	52	0.27	2

53)	37	47	53	0.34	2
54)	33	47	54	0.26	2
55)	29	47	55	0.28	2
56)	25	47	56	0.34	2
57)	21	47	57	0.24	2
58)	57	52	58	0.31	2
59)	53	52	59	0.38	3
60)	49	52	60	0.27	2
61)	45	52	61	0.45	3
62)	41	52	62	0.21	2
63)	37	52	63	0.33	2
64)	33	52	64	0.27	2
65)	29	52	65	0.32	2
66)	25	52	66	0.31	2
67)	21	52	67	0.27	2
68)	57	57	68	0.42	3
69)	53	57	69	0.41	3
70)	49	57	70	0.30	2
71)	45	57	71	0.39	3
72)	41	57	72	0.25	2
73)	37	57	73	0.39	3
74)	33	57	74	0.20	2
75)	29	57	75	0.34	2
76)	25	57	76	0.36	3
77)	21	57	77	0.31	2
78)	57	62	78	0.41	3
79)	53	62	79	0.43	3
80)	49	62	80	0.32	2
81)	45	62	81	0.32	2
82)	41	62	82	0.18	1
83)	37	62	83	0.32	2
84)	33	62	84	0.25	2
85)	29	62	85	0.29	2
86)	25	62	86	0.33	2
87)	21	62	87	0.31	2
88)	57	68	88	0.39	3
89)	53	68	89	0.43	3
90)	49	68	90	0.32	2
91)	45	68	91	0.44	3
92)	41	68	92	0.22	2
93)	37	68	93	0.35	2
94)	33	68	94	0.27	2
95)	29	68	95	0.34	2
96)	25	68	96	0.38	3
97)	21	68	97	0.33	2
98)	57	73	98	0.42	3
99)	53	73	99	0.47	3
100)	49	73	100	0.34	2
101)	45	73	101	0.43	3
102)	41	73	102	0.25	2
103)	37	73	103	0.34	2
104)	33	73	104	0.28	2
105)	29	73	105	0.32	2
106)	25	73	106	0.34	2
107)	21	73	107	0.28	2
108)	18	73	108	0.37	3
109)	57	78	109	0.42	3
110)	53	78	110	0.50	3
111)	49	78	111	0.33	2
112)	45	78	112	0.42	3
113)	41	78	113	0.25	2
114)	37	78	114	0.24	2
115)	33	78	115	0.36	3
116)	29	78	116	0.28	2
117)	25	78	117	0.32	2
118)	21	78	118	0.35	2
119)	18	78	119	0.29	2
120)	57	83	120	0.40	3
121)	53	83	121	0.45	3
122)	49	83	122	0.32	2
123)	45	83	123	0.44	3
124)	41	83	124	0.25	2
125)	37	83	125	0.37	3
126)	33	83	126	0.32	2
127)	29	83	127	0.34	2
128)	25	83	128	0.36	3
129)	21	83	129	0.30	2
130)	18	83	130	0.40	3
131)	57	88	131	0.37	3
132)	53	88	132	0.38	3
133)	49	88	133	0.29	2
134)	45	88	134	0.40	3

135)	41	88	135	0.24	2
136)	37	88	136	0.36	3
137)	33	88	137	0.32	2
138)	29	88	138	0.33	2
139)	25	88	139	0.35	2
140)	21	88	140	0.27	2
141)	18	88	141	0.40	3
142)	53	93	142	0.35	2
143)	49	93	143	0.29	2
144)	45	93	144	0.37	3
145)	41	93	145	0.24	2
146)	37	93	146	0.36	3
147)	33	93	147	0.32	2
148)	29	93	148	0.35	2
149)	25	93	149	0.40	3
150)	21	93	150	0.29	2
151)	18	93	151	0.38	3
152)	45	98	152	0.31	2
153)	41	98	153	0.28	2
154)	37	98	154	0.36	3
155)	33	98	155	0.31	2
156)	29	98	156	0.35	2
157)	25	98	157	0.42	3
158)	21	98	158	0.32	2
159)	18	98	159	0.37	3
160)	37	103	160	0.29	2
161)	33	103	161	0.32	2
162)	29	103	162	0.33	2
163)	25	103	163	0.39	3
164)	21	103	164	0.33	2
165)	18	103	165	0.39	3
166)	29	108	166	0.30	2
167)	25	108	167	0.37	3
168)	21	108	168	0.28	2
169)	18	108	169	0.39	3
170)	21	113	170	0.24	2
171)	18	113	171	0.39	3

STANDARD SEARCH RADIUS IS 8.4250

MAP 1

COUNTY LINE-ARCADE FARC 74-182 PIN 4008.00.321
SPAN NO. 3 - CORROSION POTENTIAL READINGS 10/2/75

MAP SCALE = 0.1000 INCHES ON OUTPUT MAP/UNITS ON SOURCE MAP

MAP SHOULD BE PRINTED AT 8.0 ROWS PER INCH AND 10.0 COLUMNS PER INCH

ROW = (DOWN COORDINATE - -73.50) * 0.8000
COLUMN = (ACROSS COORDINATE - -12.50) * 1.0000

DATA POINTS FOR MAP

POINT	ROW	COLUMN	DATUM	VALUE	LEVEL
1)	57	18	1	0.17	1
2)	53	18	2	0.12*	1
3)	57	23	3	0.16	1
4)	53	23	4	0.13	1
5)	49	23	5	0.11	1
6)	45	23	6	0.11	1
7)	41	23	7	0.14*	1
8)	57	28	8	0.18	1
9)	53	28	9	0.12	1
10)	49	28	10	0.12	1
11)	45	28	11	0.10	1
12)	41	28	12	0.08	1
13)	37	28	13	0.12	1
14)	33	28	14	0.13*	1
15)	57	32	15	0.17	1
16)	53	32	16	0.15	1
17)	49	32	17	0.12	1
18)	45	32	18	0.10	1
19)	41	32	19	0.10	1
20)	37	32	20	0.10	1
21)	33	32	21	0.11	1
22)	29	32	22	0.13	1
23)	25	32	23	0.13	1
24)	21	32	24	0.15	1
25)	57	37	25	0.18	1
26)	53	37	26	0.15	1
27)	49	37	27	0.12	1
28)	45	37	28	0.11	1
29)	41	37	29	0.10	1
30)	37	37	30	0.09	1
31)	33	37	31	0.11	1
32)	29	37	32	0.11	1
33)	25	37	33	0.14	1
34)	21	37	34	0.20*	2
35)	18	37	35	0.20	2
36)	57	42	36	0.17	1
37)	53	42	37	0.14	1
38)	49	42	38	0.13	1
39)	45	42	39	0.12	1
40)	41	42	40	0.12	1
41)	37	42	41	0.10	1
42)	33	42	42	0.10	1
43)	29	42	43	0.10	1
44)	25	42	44	0.12	1
45)	21	42	45	0.14	1
46)	18	42	46	0.18	1
47)	57	47	47	0.16	1
48)	53	47	48	0.13	1
49)	49	47	49	0.11	1
50)	45	47	50	0.11	1
51)	41	47	51	0.10	1
52)	37	47	52	0.09	1
53)	33	47	53	0.10	1

* Designates location of wired ground connection.

54)	29	47	54	0.10	1
55)	25	47	55	0.12	1
56)	21	47	56	0.15	1
57)	18	47	57	0.17	1
58)	57	52	58	0.20	2
59)	53	52	59	0.13	1
60)	49	52	60	0.11	1
61)	45	52	61	0.11	1
62)	41	52	62	0.10	1
63)	37	52	63	0.09	1
64)	33	52	64	0.09	1
65)	29	52	65	0.09	1
66)	25	52	66	0.13	1
67)	21	52	67	0.13	1
68)	18	52	68	0.15	1
69)	57	57	69	0.16	1
70)	53	57	70	0.13	1
71)	49	57	71	0.12	1
72)	45	57	72	0.10	1
73)	41	57	73	0.09	1
74)	37	57	74	0.09	1
75)	33	57	75	0.09	1
76)	29	57	76	0.11	1
77)	25	57	77	0.12	1
78)	21	57	78	0.14	1
79)	18	57	79	0.17	1
80)	57	62	80	0.16	1
81)	53	62	81	0.12	1
82)	49	62	82	0.10	1
83)	45	62	83	0.10	1
84)	41	62	84	0.07	1
85)	37	62	85	0.09	1
86)	33	62	66	0.10	1
87)	29	62	87	0.10	1
88)	25	62	88	0.11	1
89)	21	62	89	0.13	1
90)	18	62	90	0.17	1
91)	57	68	91	0.19	1
92)	53	68	92	0.15	1
93)	49	68	93	0.12	1
94)	45	68	94	0.10	1
95)	41	68	95	0.10	1
96)	37	68	96	0.08	1
97)	33	68	97	0.09	1
98)	29	68	98	0.10	1
99)	25	68	99	0.11	1
100)	21	68	100	0.12	1
101)	18	68	101	0.16	1
102)	57	73	102	0.17	1
103)	53	73	103	0.12	1
104)	49	73	104	0.14	1
105)	45	73	105	0.10	1
106)	41	73	106	0.06	1
107)	37	73	107	0.08	1
108)	33	73	108	0.09	1
109)	29	73	109	0.11	1
110)	25	73	110	0.11	1
111)	21	73	111	0.12	1
112)	18	73	112	0.17	1
113)	57	78	113	0.19	1
114)	53	78	114	0.13	1
115)	49	78	115	0.12	1
116)	45	78	116	0.10	1
117)	41	78	117	0.08	1
118)	37	78	118	0.09	1
119)	33	78	119	0.09	1
120)	29	78	120	0.11	1
121)	25	78	121	0.13	1
122)	21	78	122	0.12	1
123)	18	78	123	0.14	1
124)	57	83	124	0.17	1
125)	53	83	125	0.02	1
126)	49	83	126	0.12	1
127)	45	83	127	0.08	1
128)	41	83	128	0.08	1
129)	37	83	129	0.08	1
130)	33	83	130	0.09	1
131)	29	83	131	0.10	1
132)	25	83	132	0.11	1
133)	21	83	133	0.10	1
134)	18	83	134	0.14	1

135)	57	88	135	0.20	2
136)	53	88	136	0.15	1
137)	49	88	137	0.12	1
138)	45	88	138	0.09	1
139)	41	88	139	0.09	1
140)	37	88	140	0.08	1
141)	33	88	141	0.09	1
142)	29	88	142	0.11	1
143)	25	88	143	0.12	1
144)	21	88	144	0.12	1
145)	18	88	145	0.14	1
146)	57	93	146	0.19	1
147)	53	93	147	0.13*	1
148)	49	93	148	0.14	1
149)	45	93	149	0.12	1
150)	41	93	150	0.10	1
151)	37	93	151	0.09	1
152)	33	93	152	0.11	1
153)	29	93	153	0.12	1
154)	25	93	154	0.11	1
155)	21	93	155	0.13	1
156)	18	93	156	0.13	1
157)	49	98	157	0.16	1
158)	45	98	158	0.11	1
159)	41	98	159	0.13*	1
160)	37	98	160	0.11	1
161)	33	98	161	0.11	1
162)	29	98	162	0.12	1
163)	25	98	163	0.13	1
164)	21	98	164	0.14	1
165)	18	98	165	0.16	1
166)	37	103	166	0.12	1
167)	33	103	167	0.13*	1
168)	29	103	168	0.13	1
169)	25	103	169	0.15	1
170)	21	103	170	0.13	1
171)	18	103	171	0.15	1
172)	29	108	172	0.10	1
173)	25	108	173	0.14	1
174)	21	108	174	0.15	1
175)	18	108	175	0.17	1
176)	21	113	176	0.15*	1
177)	18	113	177	0.20	2

STANDARD SEARCH RADIUS IS 8.2776

* Designates location of wired ground connection.

MAP 1

COUNTY LINE-ARCADE FARC 74-182 PIN 4008.00.321
SPAN NO. 4 - CORROSION POTENTIAL READINGS 10/9/75

MAP SCALE = 0.1000 INCHES ON OUTPUT MAP/UNITS ON SOURCE MAP

MAP SHOULD BE PRINTED AT 8.0 ROWS PER INCH AND 10.0 COLUMNS PER INCH

ROW = (DOWN COORDINATE - -73.50) * 0.8000
COLUMN = (ACROSS COORDINATE - -24.50) * 1.0000

DATA POINTS FOR MAP

POINT	ROW	COLUMN	DATUM	VALUE	LEVEL
1)	57	30	1	0.14	1
2)	53	30	2	0.09	1
3)	49	30	3	0.11	1
4)	57	34	4	0.09	1
5)	53	34	5	0.09	1
6)	49	34	6	0.10	1
7)	45	34	7	0.10	1
8)	41	34	8	0.13	1
9)	57	39	9	0.09	1
10)	53	39	10	0.08	1
11)	49	39	11	0.08	1
12)	45	39	12	0.09	1
13)	41	39	13	0.10	1
14)	37	39	14	0.10	1
15)	33	39	15	0.13	1
16)	57	44	16	0.10	1
17)	53	44	17	0.09	1
18)	49	44	18	0.07	1
19)	45	44	19	0.08	1
20)	41	44	20	0.10	1
21)	37	44	21	0.10	1
22)	33	44	22	0.10	1
23)	29	44	23	0.11	1
24)	25	44	24	0.12	1
25)	57	49	25	0.11	1
26)	53	49	26	0.09	1
27)	49	49	27	0.08	1
28)	45	49	28	0.08	1
29)	41	49	29	0.08	1
30)	37	49	30	0.10	1
31)	33	49	31	0.09	1
32)	29	49	32	0.09	1
33)	25	49	33	0.09	1
34)	21	49	34	0.12	1
35)	18	49	35	0.11	1
36)	57	54	36	0.08	1
37)	53	54	37	0.08	1
38)	49	54	38	0.08	1
39)	45	54	39	0.08	1
40)	41	54	40	0.09	1
41)	37	54	41	0.09	1
42)	33	54	42	0.09	1
43)	29	54	43	0.09	1
44)	25	54	44	0.08	1
45)	21	54	45	0.07	1
46)	18	54	46	0.10	1
47)	57	59	47	0.11	1
48)	53	59	48	0.09	1
49)	49	59	49	0.08	1
50)	45	59	50	0.08	1
51)	41	59	51	0.09	1
52)	37	59	52	0.10	1
53)	33	59	53	0.09	1
54)	29	59	54	0.09	1

55)	25	59	55	0.08	1
56)	21	59	56	0.06	1
57)	18	59	57	0.11	1
58)	57	65	58	0.09	1
59)	53	65	59	0.09	1
60)	49	65	60	0.09	1
61)	45	65	61	0.08	1
62)	41	65	62	0.09	1
63)	37	65	63	0.09	1
64)	33	65	64	0.06	1
65)	29	65	65	0.09	1
66)	25	65	66	0.08	1
67)	21	65	67	0.09	1
68)	18	65	68	0.09	1
69)	57	70	69	0.09	1
70)	53	70	70	0.09	1
71)	49	70	71	0.08	1
72)	45	70	72	0.08	1
73)	41	70	73	0.09	1
74)	37	70	74	0.09	1
75)	33	70	75	0.10	1
76)	29	70	76	0.10	1
77)	25	70	77	0.08	1
78)	21	70	78	0.07	1
79)	18	70	79	0.10	1
80)	57	75	80	0.10	1
81)	53	75	81	0.07	1
82)	49	75	82	0.07	1
83)	45	75	83	0.09	1
84)	41	75	84	0.09	1
85)	37	75	85	0.10	1
86)	33	75	86	0.09	1
87)	29	75	87	0.09	1
88)	25	75	88	0.09	1
89)	21	75	89	0.10	1
90)	18	75	90	0.09	1
91)	57	80	91	0.10	1
92)	53	80	92	0.10	1
93)	49	80	93	0.11	1
94)	45	80	94	0.10	1
95)	41	80	95	0.10	1
96)	37	80	96	0.10	1
97)	33	80	97	0.11	1
98)	29	80	98	0.13	1
99)	25	80	99	0.09	1
100)	21	80	100	0.08	1
101)	18	80	101	0.09	1
102)	49	85	102	0.12	1
103)	45	85	103	0.11	1
104)	41	85	104	0.10	1
105)	37	85	105	0.10	1
106)	33	85	106	0.11	1
107)	29	85	107	0.12	1
108)	25	85	108	0.10	1
109)	21	85	109	0.09	1
110)	18	85	110	0.11	1
111)	41	90	111	0.15	1
112)	37	90	112	0.13	1
113)	33	90	113	0.12	1
114)	29	90	114	0.14	1
115)	25	90	115	0.11	1
116)	21	90	116	0.08	1
117)	18	90	117	0.12	1
118)	33	95	118	0.16	1
119)	29	95	119	0.16	1
120)	25	95	120	0.11	1
121)	21	95	121	0.09	1
122)	18	95	122	0.10	1
123)	25	100	123	0.20	2
124)	21	100	124	0.13	1
125)	18	100	125	0.12	1

STANDARD SEARCH RADIUS IS 8.4962

MAP 1

COUNTY LINE-ARCADE FARC 74-182 PIN 4008.00.321
SPAN NO. 1 - CORROSION POTENTIAL READINGS 9/28/76, 9/30/76

MAP SCALE = 0.1000 INCHES ON OUTPUT MAP/UNITS ON SOURCE MAP

MAP SHOULD BE PRINTED AT 8.0 ROWS PER INCH AND 10.0 COLUMNS PER INCH

ROW = (DOWN COORDINATE - -73.50) * 0.8000
COLUMN = (ACROSS COORDINATE - -36.00) * 1.0000

DATA POINTS FOR MAP

POINT	ROW	COLUMN	DATUM	VALUE	LEVEL
1)	57	37	1	0.21	2
2)	57	42	2	0.17	1
3)	53	42	3	0.25	2
4)	49	42	4	0.28	2
5)	57	47	5	0.13	1
6)	53	47	6	0.24	2
7)	49	47	7	0.25	2
8)	45	47	8	0.27	2
9)	41	47	9	0.28	2
10)	37	47	10	0.36	3
11)	57	52	11	0.13	1
12)	53	52	12	0.20	2
13)	49	52	13	0.22	2
14)	45	52	14	0.24	2
15)	41	52	15	0.26	2
16)	37	52	16	0.25	2
17)	33	52	17	0.26	2
18)	29	52	18	0.29	2
19)	57	57	19	0.15	1
20)	53	57	20	0.22	2
21)	49	57	21	0.22	2
22)	45	57	22	0.25	2
23)	41	57	23	0.24	2
24)	37	57	24	0.25	2
25)	33	57	25	0.27	2
26)	29	57	26	0.26	2
27)	25	57	27	0.28	2
28)	21	57	28	0.29	2
29)	18	57	29	0.29	2
30)	57	62	30	0.14	1
31)	53	62	31	0.21	2
32)	49	62	32	0.23	2
33)	45	62	33	0.21	2
34)	41	62	34	0.23	2
35)	37	62	35	0.18	1
36)	33	62	36	0.27	2
37)	29	62	37	0.26	2
38)	25	62	38	0.26	2
39)	21	62	39	0.28	2
40)	18	62	40	0.19	1
41)	57	67	41	0.11	1
42)	53	67	42	0.21	2
43)	49	67	43	0.22	2
44)	45	67	44	0.23	2
45)	41	67	45	0.22	2
46)	37	67	46	0.21	2
47)	33	67	47	0.27	2
48)	29	67	48	0.27	2
49)	25	67	49	0.26	2
50)	21	67	50	0.27	2
51)	18	67	51	0.18	1
52)	57	72	52	0.13	1
53)	53	72	53	0.21	2
54)	49	72	54	0.19	1

55)	45	72	55	0.23	2
56)	41	72	56	0.24	2
57)	37	72	57	0.22	2
58)	33	72	58	0.26	2
59)	29	72	59	0.22	2
60)	25	72	60	0.26	2
61)	21	72	61	0.27	2
62)	18	72	62	0.24	2
63)	49	77	63	0.29	2
64)	45	77	64	0.29	2
65)	41	77	65	0.22	2
66)	37	77	66	0.15	1
67)	33	77	67	0.23	2
68)	29	77	68	0.21	2
69)	25	77	69	0.22	2
70)	21	77	70	0.24	2
71)	18	77	71	0.20	2
72)	41	82	72	0.31	2
73)	37	82	73	0.18	1
74)	33	82	74	0.24	2
75)	29	82	75	0.23	2
76)	25	82	76	0.21	2
77)	21	82	77	0.27	2
78)	18	82	78	0.17	1
79)	29	87	79	0.23	2
80)	25	87	80	0.27	2
81)	21	87	81	0.25	2
82)	18	87	82	0.19	1
83)	21	92	83	0.26	2
84)	18	92	84	0.25	2

STANDARD SEARCH RADIUS IS 9.2620

MAP 1

COUNTY LINE-ARCADE FARC 74-182 PIN 4008.00.321
SPAN NO. 2 - CORROSION POTENTIAL READINGS 9/28/76, 9/29/76

MAP SCALE = 0.1000 INCHES ON OUTPUT MAP/UNITS ON SOURCE MAP

MAP SHOULD BE PRINTED AT 8.0 ROWS PER INCH AND 10.0 COLUMNS PER INCH

ROW = (DOWN COORDINATE - -73.50) * 0.8000
COLUMN = (ACROSS COORDINATE - -12.50) * 1.0000

DATA POINTS FOR MAP

POINT	ROW	COLUMN	DATUM	VALUE	LEVEL
1)	57	18	1	0.13	1
2)	53	18	2	0.21	2
3)	49	18	3	0.31	2
4)	57	23	4	0.22	2
5)	53	23	5	0.32	2
6)	49	23	6	0.30	2
7)	45	23	7	0.25	2
8)	41	23	8	0.22	2
9)	57	28	9	0.17	1
10)	53	28	10	0.32	2
11)	49	28	11	0.29	2
12)	45	28	12	0.27	2
13)	41	28	13	0.23	2
14)	37	28	14	0.20	2
15)	33	28	15	0.19	1
16)	29	28	16	0.19	1
17)	25	28	17	0.22	2
18)	57	32	18	0.20	2
19)	53	32	19	0.32	2
20)	49	32	20	0.24	2
21)	45	32	21	0.23	2
22)	41	32	22	0.20	2
23)	37	32	23	0.17	1
24)	33	32	24	0.23	2
25)	29	32	25	0.22	2
26)	25	32	26	0.20	2
27)	21	32	27	0.20	2
28)	18	32	28	0.30	2
29)	57	37	29	0.17	1
30)	53	37	30	0.23	2
31)	49	37	31	0.22	2
32)	45	37	32	0.21	2
33)	41	37	33	0.20	2
34)	37	37	34	0.18	1
35)	33	37	35	0.20	2
36)	29	37	36	0.17	1
37)	25	37	37	0.04	1
38)	21	37	38	0.13	1
39)	18	37	39	0.19	1
40)	57	42	40	0.15	1
41)	53	42	41	0.22	2
42)	49	42	42	0.22	2
43)	45	42	43	0.22	2
44)	41	42	44	0.22	2
45)	37	42	45	0.16	1
46)	33	42	46	0.20	2
47)	29	42	47	0.19	1
48)	25	42	48	0.21	2
49)	21	42	49	0.21	2
50)	18	42	50	0.17	1
51)	57	47	51	0.15	1
52)	53	47	52	0.28	2
53)	49	47	53	0.26	2
54)	45	47	54	0.26	2

55)	41	47	55	0.23	2
56)	37	47	56	0.27	2
57)	33	47	57	0.19	1
58)	29	47	58	0.19	1
59)	25	47	59	0.23	2
60)	21	47	60	0.22	2
61)	18	47	61	0.21	2
62)	57	52	62	0.12	1
63)	53	52	63	0.29	2
64)	49	52	64	0.24	2
65)	45	52	65	0.27	2
66)	41	52	66	0.28	2
67)	37	52	67	0.26	2
68)	33	52	68	0.21	2
69)	29	52	69	0.19	1
70)	25	52	70	0.31	2
71)	21	52	71	0.33	2
72)	18	52	72	0.19	1
73)	57	57	73	0.23	2
74)	53	57	74	0.28	2
75)	49	57	75	0.24	2
76)	45	57	76	0.22	2
77)	41	57	77	0.29	2
78)	37	57	78	0.32	2
79)	33	57	79	0.29	2
80)	29	57	80	0.28	2
81)	25	57	81	0.27	2
82)	21	57	82	0.25	2
83)	18	57	83	0.23	2
84)	57	62	84	0.15	1
85)	53	62	85	0.34	2
86)	49	62	86	0.28	2
87)	45	62	87	0.29	2
88)	41	62	88	0.21	2
89)	37	62	89	0.20	2
90)	33	62	90	0.22	2
91)	29	62	91	0.30	2
92)	25	62	92	0.29	2
93)	21	62	93	0.23	2
94)	18	62	94	0.21	2
95)	57	68	95	0.16	1
96)	53	68	96	0.36	3
97)	49	68	97	0.32	2
98)	45	68	98	0.30	2
99)	41	68	99	0.19	1
100)	37	68	100	0.20	2
101)	33	68	101	0.15	1
102)	29	68	102	0.18	1
103)	25	68	103	0.25	2
104)	21	68	104	0.23	2
105)	18	68	105	0.20	2
106)	57	73	106	0.19	1
107)	53	73	107	0.27	2
108)	49	73	108	0.21	2
109)	45	73	109	0.25	2
110)	41	73	110	0.19	1
111)	37	73	111	0.22	2
112)	33	73	112	0.20	2
113)	29	73	113	0.20	2
114)	25	73	114	0.24	2
115)	21	73	115	0.28	2
116)	18	73	116	0.15	1
117)	57	78	117	0.15	1
118)	53	78	118	0.23	2
119)	49	78	119	0.21	2
120)	45	78	120	0.20	2
121)	41	78	121	0.14	1
122)	37	78	122	0.15	1
123)	33	78	123	0.12	1
124)	29	78	124	0.22	2
125)	25	78	125	0.32	2
126)	21	78	126	0.25	2
127)	18	78	127	0.19	1
128)	57	83	128	0.08	1
129)	53	83	129	0.20	2
130)	49	83	130	0.17	1
131)	45	83	131	0.17	1
132)	41	83	132	0.19	1
133)	37	83	133	0.01	1
134)	33	83	134	0.16	1
135)	29	83	135	0.13	1
136)	25	83	136	0.23	2

137)	21	83	137	0.27	2
138)	18	83	138	0.20	2
139)	57	88	139	0.11	1
140)	53	88	140	0.12	1
141)	49	88	141	0.15	1
142)	45	88	142	0.18	1
143)	41	88	143	0.19	1
144)	37	88	144	0.18	1
145)	33	88	145	0.20	2
146)	29	88	146	0.16	1
147)	25	88	147	0.25	2
148)	21	88	148	0.20	2
149)	18	88	149	0.04	1
150)	57	93	150	0.18	1
151)	53	93	151	0.23	2
152)	49	93	152	0.24	2
153)	45	93	153	0.19	1
154)	41	93	154	0.18	1
155)	37	93	155	0.14	1
156)	33	93	156	0.22	2
157)	29	93	157	0.21	2
158)	25	93	158	0.19	1
159)	21	93	159	0.21	2
160)	18	93	160	0.15	1
161)	49	98	161	0.30	2
162)	45	98	162	0.27	2
163)	41	98	163	0.24	2
164)	37	98	164	0.17	1
165)	33	98	165	0.17	1
166)	29	98	166	0.15	1
167)	25	98	167	0.16	1
168)	21	98	168	0.16	1
169)	18	98	169	0.13	1
170)	37	103	170	0.22	2
171)	33	103	171	0.26	2
172)	29	103	172	0.21	2
173)	25	103	173	0.18	1
174)	21	103	174	0.16	1
175)	18	103	175	0.10	1
176)	29	108	176	0.22	2
177)	25	108	177	0.20	2
178)	21	108	178	0.20	2
179)	18	108	179	0.18	1
180)	21	113	180	0.25	2
181)	18	113	181	0.18	1

STANDARD SEARCH RADIUS IS 8.1836

MAP 1

COUNTY LINE-ARCADE FARC 74-182 PIN 4008.00.321
SPAN NO. 3 - CORROSION POTENTIAL READINGS 9/28/76, 9/30/76

MAP SCALE = 0.1000 INCHES ON OUTPUT MAP/UNITS ON SOURCE MAP

MAP SHOULD BE PRINTED AT 8.0 ROWS PER INCH AND 10.0 COLUMNS PER INCH

ROW = (DOWN COORDINATE - -73.50) * 0.8000
COLUMN = (ACROSS COORDINATE - -12.50) * 1.0000

DATA POINTS FOR MAP

POINT	ROW	COLUMN	DATUM	VALUE	LEVEL
1)	57	18	1	0.03	1
2)	53	18	2	0.19*	1
3)	49	18	3	0.22	2
4)	57	23	4	0.04	1
5)	53	23	5	0.10	1
6)	49	23	6	0.11	1
7)	45	23	7	0.19	1
8)	41	23	8	0.29*	2
9)	57	28	9	0.10	1
10)	53	28	10	0.11	1
11)	49	28	11	0.11	1
12)	45	28	12	0.10	1
13)	41	28	13	0.18	1
14)	37	28	14	0.04	1
15)	33	28	15	0.19*	1
16)	29	28	16	0.24	2
17)	57	32	17	0.10	1
18)	53	32	18	0.12	1
19)	49	32	19	0.17	1
20)	45	32	20	0.15	1
21)	41	32	21	0.12	1
22)	37	32	22	0.10	1
23)	33	32	23	0.19	1
24)	29	32	24	0.21	2
25)	25	32	25	0.24	2
26)	21	32	26	0.28	2
27)	57	37	27	0.06	1
28)	53	37	28	0.15	1
29)	49	37	29	0.13	1
30)	45	37	30	0.11	1
31)	41	37	31	0.14	1
32)	37	37	32	0.05	1
33)	33	37	33	0.13	1
34)	29	37	34	0.11	1
35)	25	37	35	0.15	1
36)	21	37	36	0.21*	2
37)	18	37	37	0.22	2
38)	57	42	38	0.02	1
39)	53	42	39	0.12	1
40)	49	42	40	0.13	1
41)	45	42	41	0.11	1
42)	41	42	42	0.12	1
43)	37	42	43	0.07	1
44)	33	42	44	0.15	1
45)	29	42	45	0.13	1
46)	25	42	46	0.11	1
47)	21	42	47	0.16	1
48)	18	42	48	0.14	1
49)	57	47	49	0.02	1
50)	53	47	50	0.11	1
51)	49	47	51	0.06	1
52)	45	47	52	0.14	1
53)	41	47	53	0.14	1
54)	37	47	54	0.10	1
55)	33	47	55	0.14	1

* Designates location of wired ground connection.

56)	29	47	56	0.11	1
57)	25	47	57	0.11	1
58)	21	47	58	0.09	1
59)	18	47	59	0.10	1
60)	57	52	60	0.06	1
61)	53	52	61	0.09	1
62)	49	52	62	0.07	1
63)	45	52	63	0.13	1
64)	41	52	64	0.14	1
65)	37	52	65	0.10	1
66)	33	52	66	0.13	1
67)	29	52	67	0.08	1
68)	25	52	68	0.13	1
69)	21	52	69	0.10	1
70)	18	52	70	0.06	1
71)	57	57	71	0.06	1
72)	53	57	72	0.14	1
73)	49	57	73	0.13	1
74)	45	57	74	0.16	1
75)	41	57	75	0.12	1
76)	37	57	76	0.10	1
77)	33	57	77	0.08	1
78)	29	57	78	0.10	1
79)	25	57	79	0.13	1
80)	21	57	80	0.12	1
81)	18	57	81	0.06	1
82)	57	62	82	0.07	1
83)	53	62	83	0.14	1
84)	49	62	84	0.12	1
85)	45	62	85	0.13	1
86)	41	62	86	0.16	1
87)	37	62	87	0.07	1
88)	33	62	88	0.12	1
89)	29	62	89	0.06	1
90)	25	62	90	0.06	1
91)	21	62	91	0.09	1
92)	18	62	92	0.05	1
93)	57	68	93	0.05	1
94)	53	68	94	0.14	1
95)	49	68	95	0.14	1
96)	45	68	96	0.13	1
97)	41	68	97	0.13	1
98)	37	68	98	0.09	1
99)	33	68	99	0.10	1
100)	29	63	100	0.09	1
101)	25	68	101	0.07	1
102)	21	68	102	0.14	1
103)	18	68	103	0.09	1
104)	57	73	104	0.06	1
105)	53	73	105	0.13	1
106)	49	73	106	0.16	1
107)	45	73	107	0.13	1
108)	41	73	108	0.15	1
109)	37	73	109	0.10	1
110)	33	73	110	0.13	1
111)	29	73	111	0.08	1
112)	25	73	112	0.12	1
113)	21	73	113	0.15	1
114)	18	73	114	0.06	1
115)	57	78	115	0.07	1
116)	53	78	116	0.15	1
117)	49	78	117	0.14	1
118)	45	78	118	0.12	1
119)	41	78	119	0.13	1
120)	37	78	120	0.14	1
121)	33	78	121	0.13	1
122)	29	78	122	0.12	1
123)	25	78	123	0.14	1
124)	21	78	124	0.15	1
125)	18	78	125	0.07	1
126)	57	83	126	0.13	1
127)	53	83	127	0.16	1
128)	49	83	128	0.15	1
129)	45	83	129	0.13	1
130)	41	83	130	0.12	1
131)	37	83	131	0.10	1
132)	33	83	132	0.12	1
133)	29	83	133	0.12	1
134)	25	83	134	0.13	1
135)	21	83	135	0.16	1
136)	18	83	136	0.08	1
137)	57	88	137	0.12	1

138)	53	88	138	0.20	2
139)	49	88	139	0.14	1
140)	45	88	140	0.13	1
141)	41	88	141	0.14	1
142)	37	88	142	0.11	1
143)	33	88	143	0.12	1
144)	29	88	144	0.12	1
145)	25	88	145	0.14	1
146)	21	88	146	0.16	1
147)	18	88	147	0.07	1
148)	57	93	148	0.15	1
149)	53	93	149	0.20*	2
150)	49	93	150	0.20	2
151)	45	93	151	0.15	1
152)	41	93	152	0.15	1
153)	37	93	153	0.08	1
154)	33	93	154	0.12	1
155)	29	93	155	0.15	1
156)	25	93	156	0.16	1
157)	21	93	157	0.16	1
158)	18	93	158	0.09	1
159)	49	98	159	0.28	2
160)	45	98	160	0.22	2
161)	41	98	161	0.21 *	2
162)	37	98	162	0.14	1
163)	33	98	163	0.19	1
164)	29	98	164	0.14	1
165)	25	98	165	0.18	1
166)	21	98	166	0.17	1
167)	18	98	167	0.13	1
168)	41	103	168	0.27	2
169)	37	103	169	0.18	1
170)	33	103	170	0.21 *	2
171)	29	103	171	0.19	1
172)	25	103	172	0.19	1
173)	21	103	173	0.17	1
174)	18	103	174	0.14	1
175)	29	108	175	0.21	2
176)	25	108	176	0.22	2
177)	21	108	177	0.20	2
178)	18	108	178	0.13	1
179)	21	113	179	0.20*	2
180)	18	113	180	0.16	1

STANDARD SEARCH RADIUS IS 8.2068

* Designates location of wired ground connection.

MAP 1

CCUNTY LINE-ARCADE FARC 74-182 PIN 4008.00.321
SPAN NO. 4 - CORROSION POTENTIAL READINGS 9/29/76, 9/30/76

MAP SCALE = 0.1000 INCHES CN CUTPUT MAP/UNITS CN SCURCE MAP

MAP SHOULD BE PRINTED AT 8.0 ROWS PER INCH AND 10.0 COLUMNS PER INCH

ROW = (DOWN COORDINATE - -73.50) * 0.8000
COLUMN = (ACROSS COORDINATE - -24.50) * 1.0000

DATA POINTS FOR MAP

POINT	ROW	COLUMN	DATUM	VALUE	LEVEL
1)	57	30	1	0.07	1
2)	53	30	2	0.18	1
3)	57	34	3	0.01	1
4)	53	34	4	0.11	1
5)	49	34	5	0.11	1
6)	45	34	6	0.15	1
7)	41	34	7	0.17	1
8)	57	39	8	0.01	1
9)	53	39	9	0.10	1
10)	49	39	10	0.10	1
11)	45	39	11	0.11	1
12)	41	39	12	0.13	1
13)	37	39	13	0.10	1
14)	33	39	14	0.24	2
15)	57	44	15	0.04	1
16)	53	44	16	0.10	1
17)	49	44	17	0.10	1
18)	45	44	18	0.09	1
19)	41	44	19	0.11	1
20)	37	44	20	0.06	1
21)	33	44	21	0.10	1
22)	29	44	22	0.13	1
23)	25	44	23	0.10	1
24)	57	49	24	0.06	1
25)	53	49	25	0.11	1
26)	49	49	26	0.11	1
27)	45	49	27	0.10	1
28)	41	49	28	0.09	1
29)	37	49	29	0.03	1
30)	33	49	30	0.10	1
31)	29	49	31	0.08	1
32)	25	49	32	0.11	1
33)	21	49	33	0.17	1
34)	18	49	34	0.08	1
35)	57	54	35	0.02	1
36)	53	54	36	0.10	1
37)	49	54	37	0.10	1
38)	45	54	38	0.08	1
39)	41	54	39	0.13	1
40)	37	54	40	0.09	1
41)	33	54	41	0.12	1
42)	29	54	42	0.07	1
43)	25	54	43	0.08	1
44)	21	54	44	0.11	1
45)	18	54	45	0.04	1
46)	57	59	46	0.08	1
47)	53	59	47	0.10	1
48)	49	59	48	0.11	1
49)	45	59	49	0.11	1
50)	41	59	50	0.10	1
51)	37	59	51	0.06	1
52)	33	59	52	0.10	1
53)	29	59	53	0.11	1
54)	25	59	54	0.09	1

55)	21	59	55	0.10	1
56)	18	59	56	0.01	1
57)	57	65	57	0.04	1
58)	49	65	58	0.12	1
59)	45	65	59	0.09	1
60)	41	65	60	0.13	1
61)	37	65	61	0.08	1
62)	33	65	62	0.10	1
63)	29	65	63	0.11	1
64)	25	65	64	0.10	1
65)	21	65	65	0.10	1
66)	18	65	66	0.01	1
67)	57	70	67	0.03	1
68)	53	70	68	0.11	1
69)	49	70	69	0.09	1
70)	45	70	70	0.12	1
71)	41	70	71	0.11	1
72)	37	70	72	0.09	1
73)	33	70	73	0.11	1
74)	29	70	74	0.12	1
75)	25	70	75	0.10	1
76)	21	70	76	0.06	1
77)	18	70	77	-0.05	L
78)	57	75	78	0.08	1
79)	53	75	79	0.12	1
80)	49	75	80	0.11	1
81)	45	75	81	0.10	1
82)	41	75	82	0.10	1
83)	37	75	83	0.07	1
84)	33	75	84	0.11	1
85)	29	75	85	0.08	1
86)	25	75	86	0.07	1
87)	21	75	87	0.06	1
88)	18	75	88	-0.08	L
89)	57	80	89	0.09	1
90)	53	80	90	0.15	1
91)	49	80	91	0.11	1
92)	45	80	92	0.13	1
93)	41	80	93	0.13	1
94)	37	80	94	0.08	1
95)	33	80	95	0.12	1
96)	29	80	96	0.12	1
97)	25	80	97	0.08	1
98)	21	80	98	0.06	1
99)	18	80	99	-0.08	L
100)	49	85	100	0.18	1
101)	45	85	101	0.12	1
102)	41	85	102	0.10	1
103)	37	85	103	0.07	1
104)	33	85	104	0.14	1
105)	29	85	105	0.11	1
106)	25	85	106	0.07	1
107)	21	85	107	0.05	1
108)	18	85	108	-0.08	L
109)	45	90	109	0.19	1
110)	41	90	110	0.15	1
111)	37	90	111	0.10	1
112)	33	90	112	0.14	1
113)	29	90	113	0.10	1
114)	25	90	114	0.10	1
115)	21	90	115	0.09	1
116)	18	90	116	-0.04	L
117)	37	95	117	0.17	1
118)	33	95	118	0.17	1
119)	29	95	119	0.12	1
120)	25	95	120	0.11	1
121)	21	95	121	0.08	1
122)	18	95	122	-0.04	L
123)	29	100	123	0.21	2
124)	25	100	124	0.16	1
125)	21	100	125	0.16	1
126)	18	100	126	-0.02	L
127)	21	105	127	0.20	2
128)	18	105	128	0.03	1

STANDARD SEARCH RADIUS IS 8.6874

APPENDIX D

A. C. RESISTANCE MEASUREMENTS

Summary

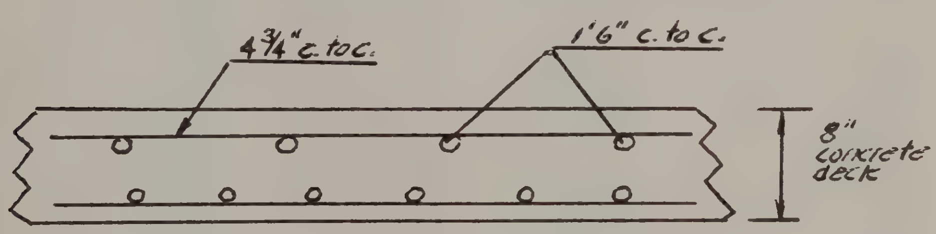
1. Arcade Test Site

   a. In 1975, A. C. Resistance measurements were only recorded on 10-15 random points on each span.

   b. In 1975, the survey crew recorded the measurement data as "less than 1000 ohms." The actual data value is not available.

   c. In 1976, measurements were recorded on random points for Spans 1, 2 and 4. Data was collected on a 5' coordinate grid on Span 3 (epoxy coated bars).

   d. Actual data values were recorded in 1976. The resistance shown were taken over 1 s.f. of deck surface area. The readings are not corrected to square-foot of bar surface area. For information: bar size = #5; transverse steel - 4-3/4" C. to C.; longitudinal steel 1'-6" C. to C.



ARCADE TEST SITE

COORDINATE GRID		A. C. RESISTANCE			
Longitudinal Reference (Ft.)	Transverse Reference (Ft.)	(ohms-square foot deck surface) 1975	1976	1977	1978
SPAN 1 - GALVANIZED RE-BAR					
6'	7'	< 1000	256		
21'	37'	"	370		
26'	12'	"	330		
36'	7'	"	328		
36'	42'	"	540		
41'	12'	"	370		
46'	17'	"	287		
46'	42'	"	370		
51'	37'	"	270'		
SPAN 2 - GALVANIZED RE-BAR					
10'	7'	< 1000	238		
15'	12'	"	235		
20'	37'	"	300		
30'	17'	"	375		
45'	47'	"	216		
50'	17'	"	238		
65'	7'	"	268		
65'	37'	"	220		
80'	12'	"	223		
90'	42'	"	266		

COORDINATE GRID		A. C. RESISTANCE (ohms-square foot deck surface)			
Longitudinal Reference (Ft.)	Transverse Reference (Ft.)	1975	1976	1977	1978
SPAN 3 - EPOXY COATED RE-BAR					
5'	2'		355		
*	7'		520		
	12'		360		
10'	2'		425		
	7'		485		
	12'	< 1000	370		
	17'		510		
*	22'		430		
15'	2'		440		
	7'		410		
	12'		500		
	17'	< 1000	550		
	22'		380		
	27'		430		
*	32'		375		
	37'		390		
20'	2'		435		
	7'		415		
	12'		350		
	17'		415		
	22'		330		
	27'		410		
	32'		280		
	37'		292		
	42'		318		
	47'		338		
25'	2'		440		
	7'	< 1000	455		
	12'		505		
	17'		440		
	22'		350		
	27'		395		
	32'		298		
	37'	< 1000	455		
	42'		385		
*	47'		328		
	51'		340		
30'	2'		555		
	7'		570		
	12'		435		
	17'	< 1000	485		
	22'		330		
	27'		395		

* Designates location of wired ground connection.

COORDINATE GRID		A. C. RESISTANCE (ohms-square foot deck surface)			
Longitudinal Reference (Ft.)	Transverse Reference (Ft.)	1975	1976	1977	1978
Span 3 - EPOXY COATED RE-BAR					
	32'		336		
	37'		336		
	42'		440		
	47'		305		
	51'		-		
35'	2'		365		
	7'		500		
	12'		590		
	17'	<1000	332		
	22'		435		
	27		380		
	32'		329		
	37'		390		
	42'		375		
	47'	<1000	315		
	51'		350		
40'	2'		420		
	7'		455		
	12'		480		
	17'		400		
	22'		365		
	27'		375		
	32'		296		
	37'		330		
	42'		328		
	47'		340		
	51'		380		
45'	2'		425		
	7'		385		
	12'		385		
	17'		405		
	22'		375		
	27'		345		
	32'		365		
	37'		328		
	42'		330		
	47'		328		
	51'		338		
50'	2'		465		
	7'		304		
	12'		365		
	17'	<1000	375		
	22'		303		
	27'		405		
	32'		296		

COORDINATE GRID		A. C. RESISTANCE (ohms-square foot deck surface)			
Longitudinal Reference (Ft.)	Transverse Reference (Ft.)	1975	1976	1977	1978
<u>Span 3 - EPOXY COATED RE-BAR</u>					
	42'		296		
	47'		425		
	51'		375		
55'	2'		485		
	7'		385		
	12'		430		
	17'		355		
	22'		306		
	27'		370		
	32'		410		
	37'		312		
	42'		350		
	47'		298		
	51'		355		
60'	2'		380		
	7'	<1000	400		
	12'		322		
	17'		420		
	22'		348		
	27'		328		
	32'		310		
	37'		350		
	42'	<1000	390		
	47'		320		
	51'		415		
65'	2'		420		
	7'	<1000	380		
	12'		430		
	17'		420		
	22'		276		
	27'		365		
	32'		410		
	37'		480		
	42'		475		
	47'		298		
	51'		360		
70'	2'		410		
	7'		360		
	12'		342		
	17'		332		
	22'		282		
	27'		355		
	32'		350		
	37'		340		
	42'		335		

COORDINATE GRID		A. C. RESISTANCE			
Longitudinal Reference (Ft.)	Transverse Reference (Ft.)	(ohms-square foot deck surface) 1975	1976	1977	1978
Span 3 - EPOXY COATED RE-BAR					
	47'		390		
	51'		395		
75'	2'		370		
	7'		410		
	12'		375		
	17'		328		
	22'		338		
	27'		365		
	32'		365		
	37'		290		
	42'		334		
	47'		375		
	51'		580		
80'	2'		332		
*	7'		385		
	12'	< 1000	380		
	17'		288		
	22'		370		
	27'		340		
	32'		290		
	37'	< 1000	410		
	42'		365		
	47'		300		
	51'		365		
85'	12'		316		
	17'		365		
*	22'		304		
	27'		370		
	32'		294		
	37'		332		
	42'		300		
	47'		312		
	51'		316		
90'	22'		245		
	27'		340		
*	32'		302		
	37'		302		
	42'		332		
	47'		306		
	51'		310		
95'	37'		290		
	42	< 1000	286		
	47'		350		
	51'		322		
*100	47'		286		
	51'		290		

* Designates location of wired connection

COORDINATE GRID		A. C. RESISTANCE (ohms-square foot deck surface)				
Longitudinal Reference (Ft.)	Transverse Reference (Ft.)	1975	1976	1977	1978	1979
SPAN 4- UNCOATED RE-BAR						
15'	12'	< 1000	410			
20'	32'	"	375			
25'	7'	"	440			
25'	32'	"	360			
30'	32'	"	350			
35'	12'	"	425			
45'	37'	"	410			
50'	7'	"	390			
50'	42'	"	450			
55'	12'	"	360			
70'	37'	"	390			